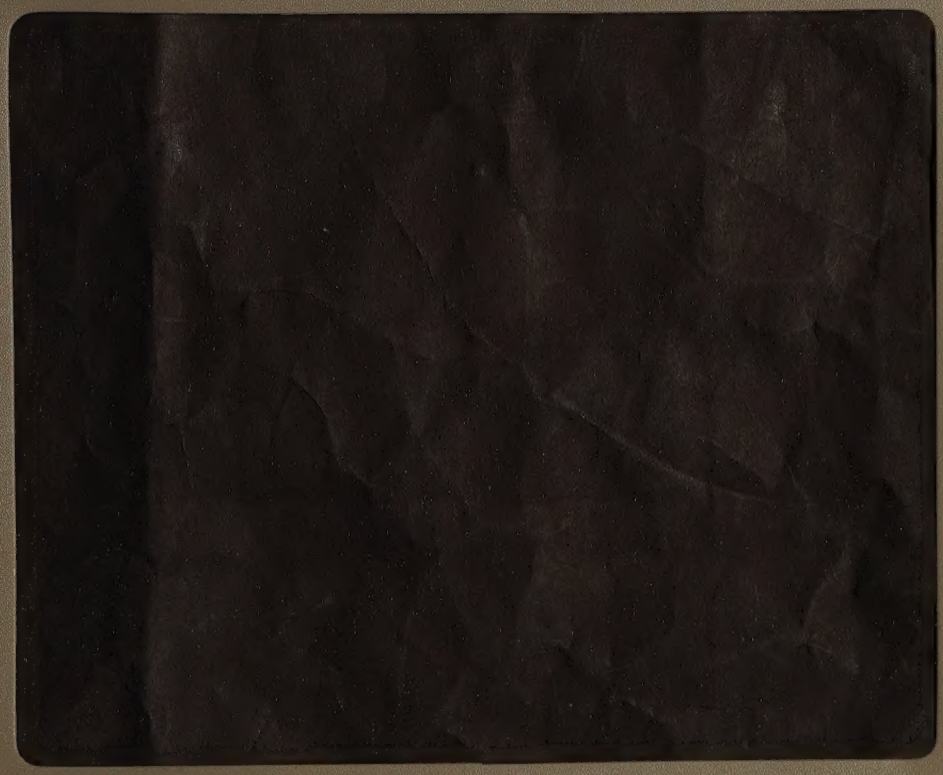
SC LABS



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NOTE

This manual documents the Model 2030A and its assemblies at the revision levels shown in Appendix 7A. If your instrument cntains assemblies with different revision lettes, it will be necessary for you to either update or backdate this manual. Refer to the supplemental change/errata sheet for newer assemblies, or to the backdating sheet in Appendix 7A for older assemblies.

2030A

Programmable Printer

Instruction Manual

P/N 504035
August 1979

FLUKE®

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WARRANTY

Notwithstanding any provision of any agreement the following warranty is exclusive:

The JOHN FLUKE MFG. CO., INC., warrants each instrument it manufactures to be free from defects in material and workmanship under normal use and service for the period of 1-year from date of purchase. This warranty extends only to the original purchaser. This warranty shall not apply to fuses, disposable batteries (rechargeable type batteries are warranted for 90-days), or any product or parts which have been subject to misuse, neglect, accident, or abnormal conditions of operations.

In the event of failure of a product covered by this warranty, John Fluke Mfg. Co., Inc., will repair and calibrate an instrument returned to an authorized Service Facility within 1 year of the original purchase; provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may, at its option, replace the product in lieu of repair. With regard to any instrument returned within 1 year of the original purchase, said repairs or replacement will be made without charge. If the failure has been caused by misuse, neglect, accident, or abnormal conditions of operations, repairs will be billed at a nominal cost. In such case, an estimate will be submitted before work is started, if requested.

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2. On receipt of the shipping instructions, forward the instrument, transportation prepaid. Repairs will be made at the Service Facility and the instrument returned, transportation prepaid.

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All shipments of JOHN FLUKE MFG. CO., INC., instruments should be made via United Parcel Service or "Best Way"* prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid and of adequate size. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL PURCHASER

The instrument should be thoroughly inspected immediately upon original delivery to purchaser. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument is damaged in any way, a claim should be filed with the carrier immediately. (To obtain a quotation to repair shipment damage, contact the nearest Fluke Technical Center.) Final claim and negotiations with the carrier must be completed by the customer.

The JOHN FLUKE MFG. CO., INC, will be happy to answer all applications or use questions, which will enhance your use of this instrument. Please address your requests or correspondence to: JOHN FLUKE MFG. CO., INC., P.O. BOX C9090, EVERETT, WASHINGTON 98206, ATTN: Sales Dept. For European Customers: Fluke (Holland) B.V., P.O. Box 5053, 5004 EB, Tilburg, The Netherlands.

*For European customers, Air Freight prepaid.

John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, Washington 98206

Rev. 6/81

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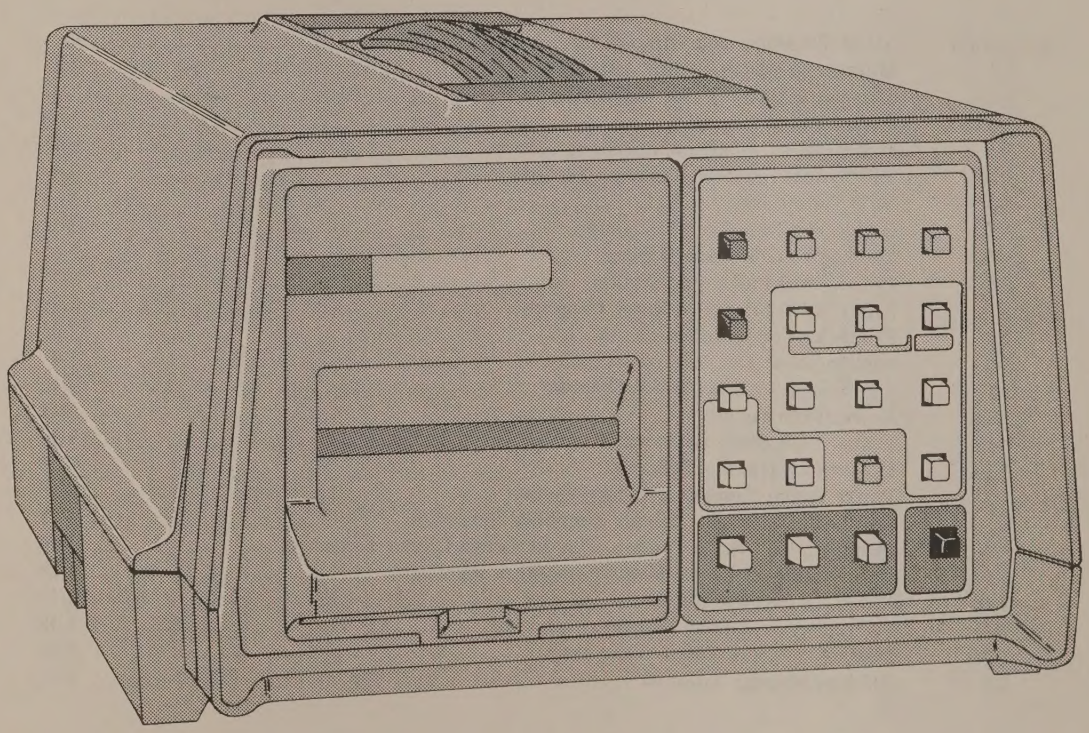


2030A Programmable Printer

Section 1
Introduction & Specifications

1-1. INTRODUCTION

1-2. The Model 2030A Programmable Printer is a 20-character thermal line printer designed as a recording peripheral device for use with digital measurement instruments. It will print up to 20 characters per line; the character set includes the standard 64 character ASCII upper-case set, plus special codes to print a degree symbol, Greek letters Mu (μ) and Omega (Ω), and lower case f, k, m, n, p, s, and z. All special codes are listed in Table 1-1.

1-3. A maximum of nine Fluke PTI format instruments may be connected to the 2030A Programmable Printer through two Model Y2034 Interconnect Accessories. The printer scans all nine input instruments and prints information received from each during each print cycle. A print cycle may be initiated by the SINGLE PRINT switch, the CONTINUOUS PRINT switch, or by Interval Print front panel programming. A print cycle may also be initiated from a remote switch through a rear panel connector.

Table 1-1. Special Printer Codes

ASCII CHARACTER CODE	PRINTER RESPONSE
Control J (Line Feed)	Terminate Input Data String
Control L (Form Feed)	Space One Line
Lower Case d	Degree Symbol (°)
Lower Case f	Lower Case f
Lower Case k	Lower Case k
Lower Case m	Lower Case m
Lower Case n	Lower Case n
Lower Case p	Lower Case p
Lower Case r	Omega Symbol (Ω)
Lower Case s	Lower Case s
Lower Case u	Micro Symbol (μ)
Lower Case z	Lower Case z

1-4. In addition to printing information supplied by the input digital instruments, the 2030A Programmable Printer will supply printed time annotation (Real Time, Elapsed Time, or Interval Time) and a six-digit numeric header annotation at the start of each print cycle.

1-5. One test instrument input may be selected through a special address feature for use with a limits comparison function, a math function, a special annotation function, or a trace print mode. The limits comparison function initates a print cycle when the input data exceeds or falls below operator-set limits; the math function scales the selected input using operator-entered constants; the special annotation function allows the operator to enter a maximum of four annotation characters for the selected instrument input. In the trace print mode, the printer produces a strip chart reflecting input data variations.

1-6. The Model 2030A Programmable Printer operates using one of three input power sources. Two input ac line voltage ranges are switch selectable: 90 to 132V ac or 180 to 250V ac. Either ac line range requires a frequency between 47 Hz and 440 Hz. One rear panel connector is provided for ac line voltage input. Refer to Section 4 of this manual for instructions on verifying or changing the input line voltage switch settings. The 2030A Programmmable Printer will also operate from a +12V dc supply. One rear panel connector containing two screw-type terminals is provided for a dc voltage input. The terminals are marked for polarity.

1-7. Communication between the 2030A Programmable Printer and an input instrument, or the Model Y2034 Interconnect Accessory, is through a 36-pin amp "Champ" Series connector. The printer connector is male. Data, address, and handshake signals in the PTI format (a unique Fluke format) are transferred through the connector in either a handshake or clocked mode.

1-8. Physically, the Model 2030A Programmable Printer consists of three circuit boards mounted in a PTI (Portable Test Instrument) Case. The three circuit boards are: the Keyboard, the Input Interface Board, and the Printer PCB. The lightweight, durable plastic, PTI case can be stacked and latched to other instruments in PTI cases to form a test system.

1-9. No options are available for the 2030A Programmable Printer. There are, however, several accessories. These are described in Section 6 of this manual, the Option and Accessory Information section, and listed in Table 1-2.

Table 1-2. Accessories

ACCESSORY	DESCRIPTION
Y2028	Interface (BCD to PTI)
Y2034	Interconnect (5 Input – 1 Output)
Y7203	Cable Assembly – 2 Foot – 36-pin
Y7204	Cable Assembly – 5 Foot – 36-pin
Y2016	Rack Panel

1-10. SPECIFICATIONS

1-11. Specifications for the Model 2030A Programmable Printer are listed in Table 1-3.

Table 1-3. Specifications

OPERATING CHARACTERISTICS	
Type	Thermal, 20-column
Character Set	64-Upper case ASCII plus special characters listed in Table 1-1.
Scan Capability	Maximum of nine instruments automatically (requires two Y2034 Interconnect Accessories).
Print Speed	Three lines per second.
Scan Speed	Three instruments per second (maximum).
Line Spacing	Approximately 2.4 lines per cm (6 lines per inch).
Print Modes	Single, Continuous, Trace, Interval, Interval Trace, Interval Limit, Remote.
Time Selection	Elapsed Time (ET), Real Time (RT), Elapsed Time-Interval (ET & IT), Real Time-Interval (RT & IT).
ENVIRONMENTAL REQUIREMENTS	
Operating Environment	
Temperature	0°C to 50°C (32°F to 122°F).
Humidity	95% - 0°C to 25°C (32°F to 77°F). 75% - 25°C to 40°C (77°F to 104°F). 45% - 40°C to 50°C (104°F to 122°F).
Storage Environment	
Instrument	–20°C to +70°C (–4°F to +158°F).
Paper	22°C, 50% RH, (90% contrast maintained for one year). 45°C, 80% RH, (90% contrast maintained for one week).
Shock and Vibration	Meets MIL-T-2800 Specifications.
PROGRAMMABLE PARAMETERS	
Time	6-digit Real Time (HR:MIN:SEC).
Interval	6-digit Interval Time (HR:MIN:SEC).
Header	6-digit Reference Number.
Math	Scales one instrument input data.
A	6-digit constant used in Math and Trace.
B	6-digit constant used in Math and Trace.
HI LIM	6-digit high limit values.
LO LIM	6-digit low limit values.
SPEC ADR	1-digit special address
UNITS	4 alphanumeric characters, 2 or 3 digit code to select each character.

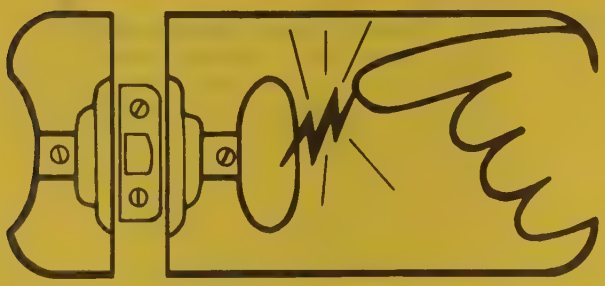
Table 1-3. Specifications (cont)

GENERAL SPECIFICATIONS	
Weight	Approximately 9 pounds (with paper).
Power	90 to 132V ac, 48 to 440 Hz. 180 to 250V ac, 48 to 440 Hz. 11 to 15V dc 40 Watts maximum.
Case Size	20.45 cm W x 13.08 cm H x 32.69 cm L (8.05 in. x 5.15 in. x 12.85 in.) See Figure 1-1.
Paper Advance Type	Belt drive - stepping motor.
Paper Type	Thermal sensitive - 2.5 inches wide x 240 feet long. (3M Type 162.)
Plug Compatible	Thermometers: Fluke 2180A and 2190A Scanner: Fluke 2300A Counters: Fluke 7200A Series DVM: Fluke 8920A DMMs: Fluke 8600A, 8800A, 8810A, (All DMMs and DVMs require Option -521 for use with the 2030A Printer.) Interconnect Accessory: Fluke Y2034 Interface (BCD to PTI): Fluke Y2028
Protection Class 1	Relates solely to insulation or grounding properties as defined in IEC 348.

static awareness

A Message From

John Fluke Mfg. Co., Inc.

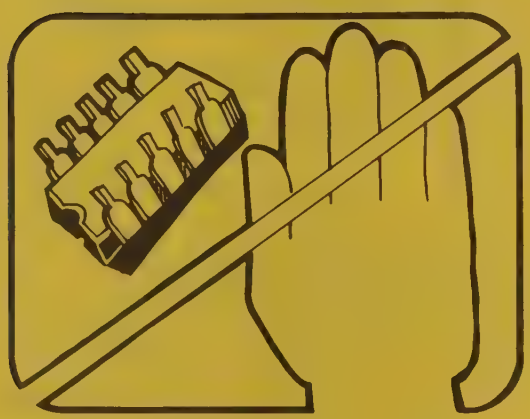


Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

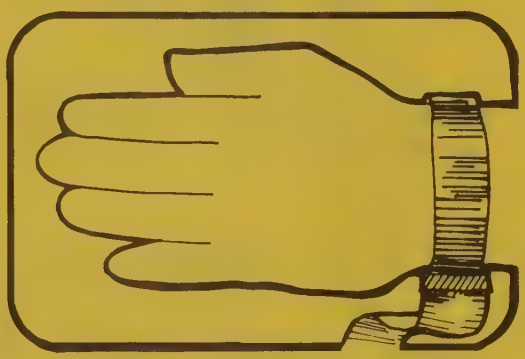
1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol "⊗"

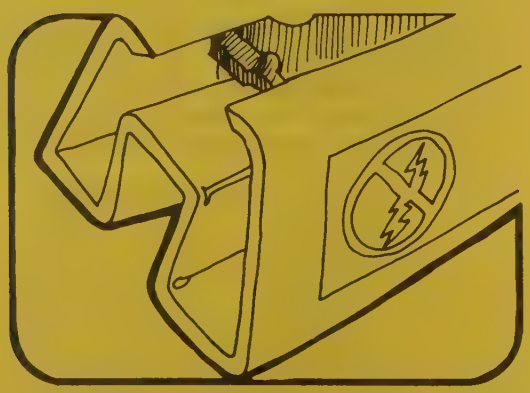
The following practices should be followed to minimize damage to S.S. devices.



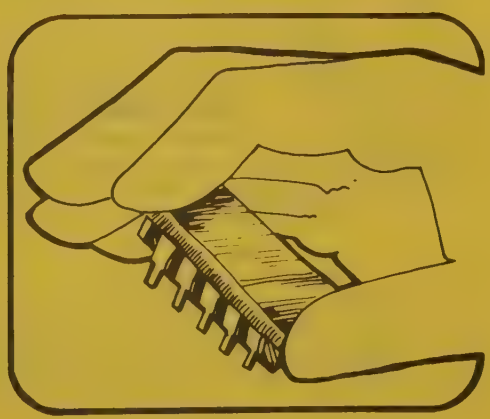
1. MINIMIZE HANDLING



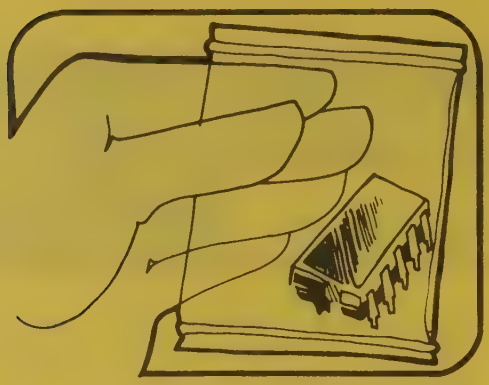
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES



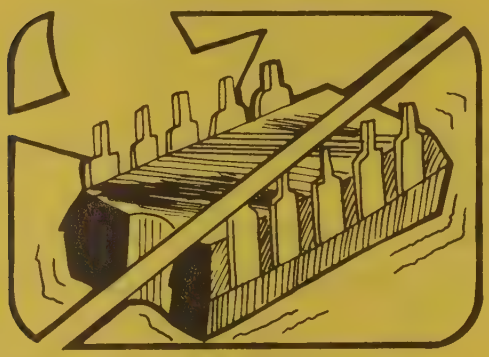
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



4. HANDLE S.S. DEVICES BY THE BODY

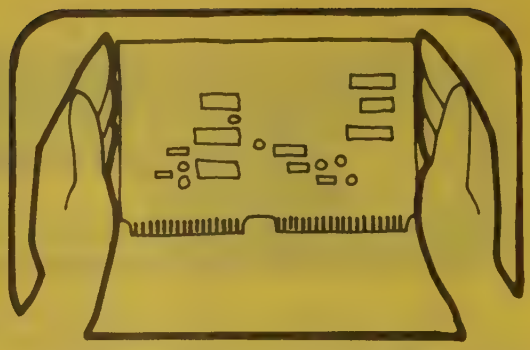


5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT

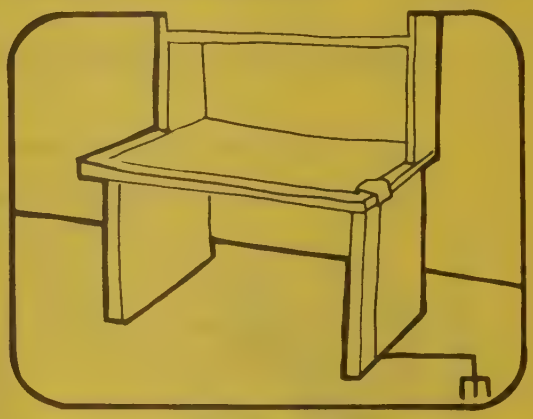


6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE

7. AVOID PLASTIC, VINYL AND STYROFOAM® IN WORK AREA



8. WHEN REMOVING PLUG-IN ASSEMBLIES, HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR USUALLY PROVIDES COMPLETE PROTECTION TO INSTALLED SS DEVICES.



9. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION

10. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

11. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

Anti-static bags, for storing S.S. devices or pcbs with these devices on them, can be ordered from the John Fluke Mfg. Co., Inc.. See section 5 in any Fluke technical manual for ordering instructions. Use the following part numbers when ordering these special bags.

John Fluke Part No.	Description
680892	5" x 8" Bag
680934	8" x 10" Bag
680942	8" x 12" Bag
680983	12" x 16" Bag
681023	18" x 18" Bag
Pink Poly Sheet 30" x 60" x 60 Mil P/N RC-AS-1200 $20.00	Wrist Strap P/N TL6-60 $7.00

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AND GENERAL DYNAMICS, POMONA DIV.

• Dow Chemical

J0089C-07U8412/SE EN Litho in U.S.A.

Section 2
Operating Instructions

2-1. INTRODUCTION

2-2. This section of the manual contains information regarding installation and operation of the Model 2030A Programmable Printer. It is recommended that the contents of this section be read and understood before any attempt is made to operate the instrument. Should difficulties arise during operation, please contact your nearest Fluke Technical Service Center, or the John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, WA 98206, telephone (206) 342-6300. A list of Technical Service Centers is located in Section 7 of this manual.

2-3. SHIPPING INFORMATION

2-4. Model 2030A Programmable Printers are packaged and shipped in a foam-packed container. Upon receipt of the instrument, a thorough inspection should be made to reveal any possible shipping damage. Special instructions for inspection and claims are included on the shipping carton.

2-5. If reshipment of the instrument is necessary, the original container should be used. If the original container is not available, a new one can be obtained from the John Fluke Mfg. Co., Inc. Please include the instrument model number when requesting a new shipping container.

2-6. INPUT POWER

2-7. Model 2030A Programmable Printers operate with any of three possible input voltages. Two ac line voltage ranges are switch selectable: 90 to 132V ac or 180 to 250V ac. Either ac voltage selected must be of a frequency between 47 Hz and 440 Hz. Refer to Section 4 of this manual for instructions on verifying or changing the input line voltage switch settings. The printer will also operate from a +12V dc voltage supply. External 12V dc connections are provided on the rear panel. The connections are screw-type terminal block connections, and they are marked for polarity. Both the ac and dc inputs may be connected simultaneously; if the ac input should fail, the printer will switch automatically to dc operation.

CAUTION

Before connecting the 2030A Programmable Printer to the local ac line voltage, verify that the input voltage switch setting matches the local line voltage. Refer to the rear panel decal.

2-8. The rear panel ac connector is a three-prong, U-ground connector which permits the printer to be connected, through the power cord, to the applicable line voltage. The offset ground prong on this connector should be connected, through the power cord, to a high quality earth ground.

2-9. INSTALLATION

2-10. Model 2030A Programmable Printers are packaged and installed in PTI (Portable Test Instrument) cases. These cases are stackable, and they may be latched together, allowing the operator to fasten the printer together with several accessories and test instruments to form one easily transportable system. Maximum weight for one stacked unit system is 40 pounds.

2-11. To prepare the printer for operation, first verify that the input voltage select switch on the Printer PCB is in the correct position for the local line voltage. Refer to Section 4 of this manual for access information. Plug the input line power cord into the applicable power source, or connect a +12V dc source to the 12V dc input connector block. Verify that all connected test instruments have the

correct preset address. If only one test instrument is to be used with the printer, connect the test instrument to the rear panel, 36-pin, printer I/O connector. Cable accessory Y7203 or Y7204 may be used for this connection. If more than one test instrument is to be used with the printer, connect the Interconnect Accessory, Y2034, to the printer rear panel I/O connector through Cable Assembly Y7203 or Y7204. Then connect the desired test instruments to the Interconnect Accessory using additional cable assembly accessories as shown in Figure 2-1. Up to five test instruments may be used with one Y2034. Nine test instruments may be connected through two Y2034 Interconnect Accessories.

2-12. OPERATING FEATURES

2-13. The 2030A controls, indicators, and connectors are shown in Figure 2-2 and described in Table 2-1.

2-14. OPERATING NOTES

2-15. The following paragraphs describe various conditions that could effect 2030A Programmable Printer operation. They also describe minor, operator-performed, periodic, service procedures. The operator should familiarize himself with these conditions and procedures prior to operating the 2030A Programmable Printer.

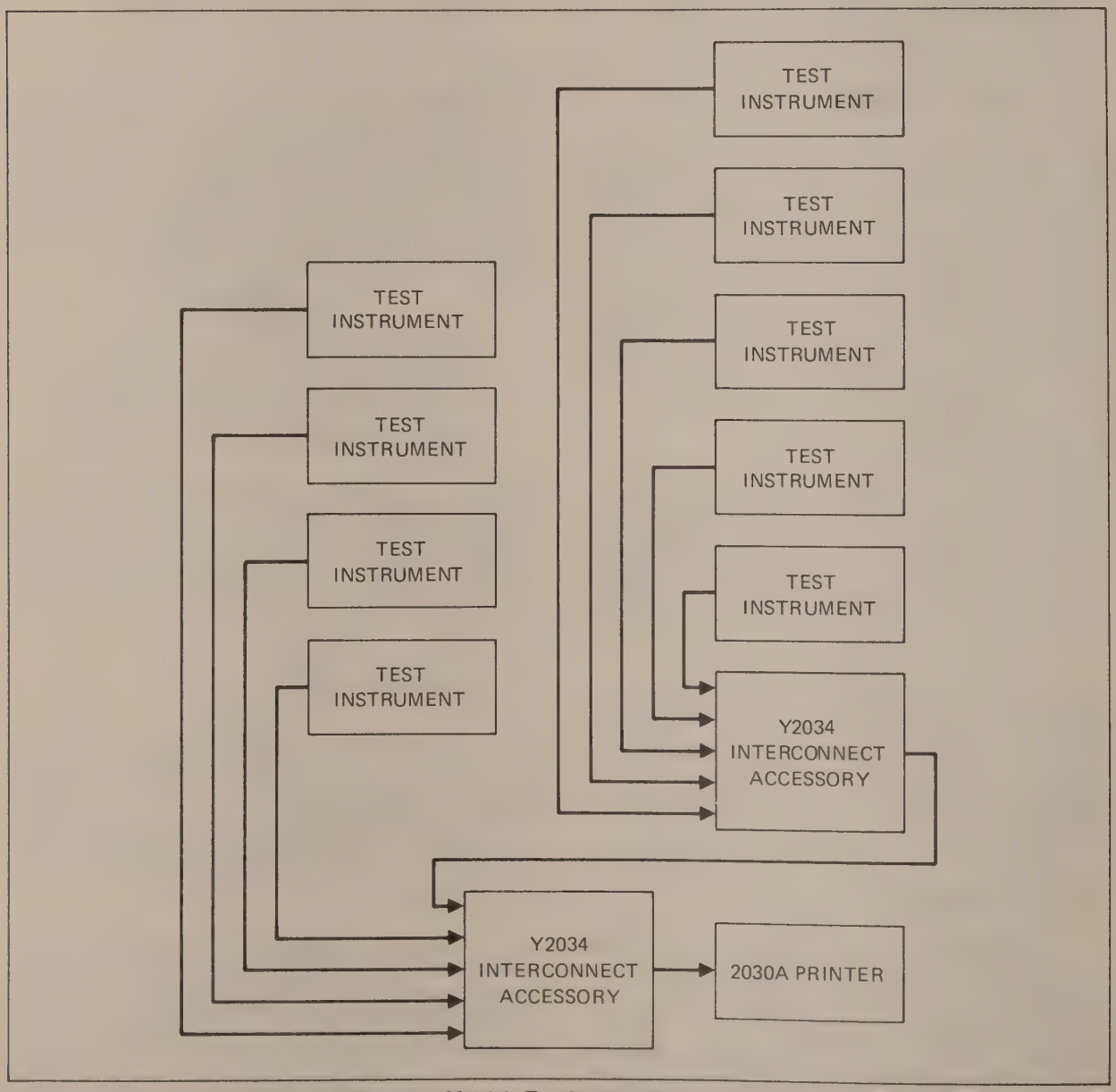


Figure 2-1. Multiple Test Instrument Connection

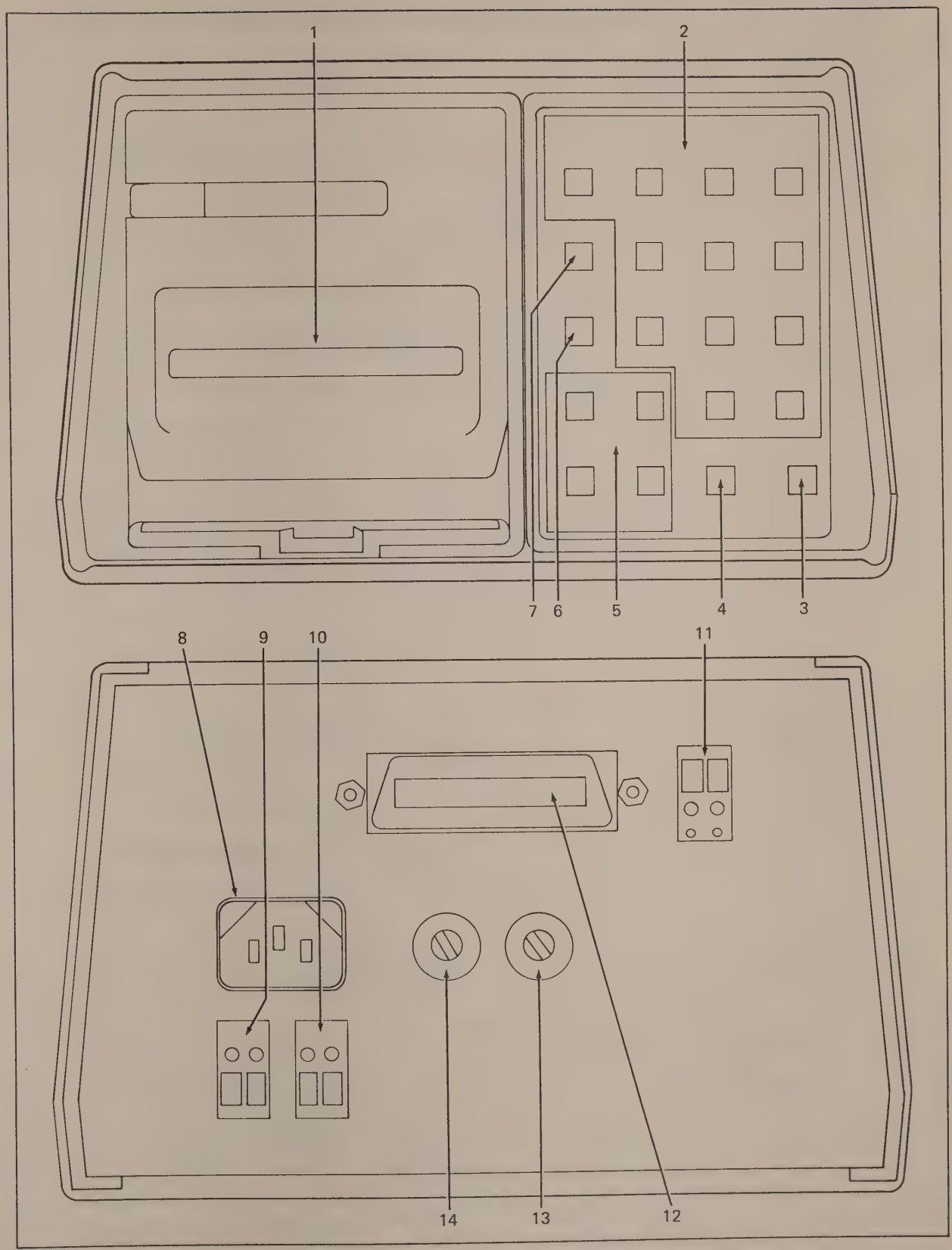


Figure 2-2 . Controls, Indicators, and Connectors

Table 2-1. Controls, Indicators, and Connectors

REF. NO.	NAME	FUNCTION
1	Print Unit	Twenty-column thermal line printer. Provides hard copy.
2	PROGRAMMING Keys	Twelve keys used to program digits and select program operational functions.
		f: Function selection. Used to select operation functions.
		7/TIME: Programs digit 7 or selects real TIME for programming.
		8/INTERVAL: Programs digit 8 or selects INTERVAL time for programming.
		9/HEADER: Programs digit 9 or selects HEADER number for programming.
		4/A: Programs digit 4 or selects A constant for programming.
		5/B: Programs digit 5 or selects B constant for programming.
		6/MATH: Programs digit 6 or selects MATH function for programming.
		1/HI LIM: Programs digit 1 or selects high limit for programming.
		2/LO LIM: Programs digit 2 or selects low limit for programming.
		3/UNITS: Programs digit 3 or selects annotation for programming.
		0: Programs digit 0.
		−/SPEC ADR: Programs dash or minus (−) character or selects special address for programming.
3	POWER ON/OFF	Switches power to printer circuitry.
4	PAPER ADVANCE	Advances print unit paper.
5	PRINT Keys	Four switches used to establish PRINT mode.
		CONT: Initiates continuous scan and print sequences until manually reset.
		SINGLE: Initiates a single scan and print sequence.
		TRACE: Initiates a trace of print dots using A and B constants to scale input data.
		INTERVAL: Initiates scan and print sequence at the time interval established by programming.
6	ENTER	Enters programmed value.
7	DECIMAL/STOP	Stops all PRINT modes except continuous or programs a decimal point.
8	LINE VOLTAGE CONNECTOR	3-prong line voltage connector.
9	AUX SUPPLY 12V dc	Connections for 12V external power input.
10	PRINT COMMAND	Connections for remote print input.
11	LIMITS	Connections for external alarm device.
12	DATA INPUT	Connection for input test instrument or Y2028.
13	F2	External 12V dc fuse.
14	F1	Line ac fuse.

2-16. Remote Print Operation

2-17. An external device may initiate a print cycle through the PRINT COMMAND connector on the printer rear panel. A switch closure between the two connector terminals initiates a single print cycle; a maintained switch closure initiates continuous print cycles as long as it is maintained.

2-18. Fuse Replacement

2-19. The ac line input and external dc input are individually fuse protected. Both fuses are readily accessible from the outside of the rear panel. The ac line input fuse (F1) should be replaced with a ½ ampere slo-blo fuse if the 90 to 132 volt input range is in use; use a ¼ ampere replacement if the 180 to 250 volt input range is in use. The external dc input fuse (F2) requires a 5 ampere slo-blo replacement.

2-20. Paper Replacement

2-21. Paper used in the 2030A Programmable Printer is 2½ inches wide, and it is supplied in 240 foot rolls. The recommended paper type is 3M-162. It may be ordered from John Fluke Mfg. Co., Inc., or from the 3M Corporation. Use of other paper types may result in paper feed problems. Use the following procedure to install paper in the 2030A:

1. Lift the latch located under the front of the print unit cover to release the print unit.

2. While holding the latch up, pull the print unit out to the stop point.

3. Lift the empty cardboard roll and plastic dowel pin out of the print unit housing.

4. Place a new roll of paper on the dowel pin, and reinstall the paper and dowel pin in the print unit housing.

5. Insert the end of the paper roll in the slot at the inside front of the print unit housing, and push the PAPER ADVANCE switch on the printer front panel to feed the paper through the printhead area.

2-22. Function Programming

2-23. Ten printer functions and two print modes may be initiated using key f in the PROGRAMMING group. Leading zeros need not be entered when entering a new value. For example: to enter an interval time of 20 seconds, push key f, INT TIME, 2, 0, and ENTER. To enter an interval time of 2 minutes, push key f, INT TIME, 2, 0, 0, and ENTER. Key f, in conjunction with ten additional PROGRAMMING group keys, initiates the following functions. (Refer to Table 2-2, Glossary.)

1. TIME - When the TIME key is pushed following the f key, the 2030A will print elapsed time (ET XX:XX:XX) or real time (RT XX:XX:XX). The printer is initialized in elapsed time. To establish real time operation, push f, then TIME, followed by two digits representing the hour (00 to 24), two digits representing the minutes (00 to 59), and two digits representing the seconds (00 to 59). Then push the ENTER key. Entering a time of 0 places the printer in elapsed time operation again. Pressing any non-stop print mode key resets the elapsed time clock to zero.

2. INTERVAL - When the INTERVAL key is pushed following the f key, the 2030A will print the interval time (IT XX:XX:XX). To establish a new interval time, push key f, followed by the INTERVAL key, then six (or less) digits denoting the new interval time, then push ENTER. Intervals from 00:00:01 to 99:59:59 are possible.

3. HEADER - When the HEADER key is pushed following the f key, the 2030A will print the HEADER number (HD XXXXXX). To establish a new header number, push the f key, then the HEADER key, then six (or less) digits denoting the new header number, then push ENTER. The header number can be used for a test number, lot number, day code, or any other customer information.

4. A - When the A key is pushed following the f key, the 2030A will print the six digit A constant with a floating decimal point, (A XXX.XXX). To establish a new A constant, push the f key, then the A key, then six (or less) digits denoting the new A constant and a decimal point if necessary, then push ENTER. The decimal point may be entered at any point in the constant. (In Trace print mode, only four decimal places are allowable.)

5. B - When the B key is pushed following the f key, the 2030A will print the six digit B constant (B -XXXXXX). To establish a new B constant push key f, then key B, then six digits (or less) denoting the new constant. If the new B constant is a negative value, push the minus (–1) key at any time before ENTER. Push the ENTER key. The B constant must be a non-decimal number. The B constant is used in the scaling equation.

6. MATH - When the MATH key is pushed following the f key, the math function will be set if it is in a reset condition; if the math function is in a set condition when the keys are pushed, it will be reset. The 2030A will print MATH SET if the math function is set. It will print MATH RESET if the math function is reset. When the math function is set, the scaling equation will be applied to the data

from the test instrument selected through the special address. The operator-entered A and B constants are used in the scaling equation P = A (D–B).

NOTE

P = Printed value
A & B = user defined constants
D = Displayed numeric value

7. HI LIM - When the HI LIM key is pushed following the f key, the 2030A will print the six digit high limit (HL XXXXXX). A minus sign (–) may be printed before the digits if the high limit is a negative value. To establish a new high limit, push the f key, then the HI LIM key; push the – (minus) key at any time, if necessary, then six (or less) digits denoting the new limit, then push ENTER. High and low limits are used only in the interval limit print mode, and they apply only to the selected special address instrument. Limits comparison is performed using the printed number, ignoring the decimal point.

8. LO LIM - When the LO LIM key is pushed following the f key, the 2030A will print the six digit low limit (LL XXXXXX). A minus sign (–) may be printed before the digits if the low limit is a negative value. To establish a new low limit, push the f key, then the LO LIM key; push the – (minus) key at any time, if necessary, then six digits (or less) denoting the new limit, then push the ENTER key. Low limit is used only in the interval limit print mode, and it applies only to the selected special address instrument.

Table 2-2. Glossary

AUTOMATIC ANNOTATION GLOSSARY	
SYMBOL	**MEANING**
A	User entered constant A
B	User entered constant B
BUS DOWN	Diagnostic
ET	Elapsed time
IMPROPER ENTRY	Diagnostic
IT	Time Interval
HD	Header Number
HL	High Limit
LL	Low Limit
m	Math function in use
m MATH SET	Math function initiated
MATH RESET	Math function terminated
RT	Real Time
SA	Special Address
STOP	Print mode terminated
UN	Programmed Engineering Units
UNITS RESET	Units register cleared
>	Printed number is above High Limit
<	Printed number is below Low Limit
^	Math caused overflow

MATH FUNCTION GLOSSARY	
TERM	**MEANING**
A	User entered constant
B	User entered constant
D	Measurement instrument displayed value
D*	Measurement instrument displayed value ignoring decimal point
DELTA	Algebraic difference
% DELTA	Percent algebraic difference
D_{HI}	Highest displayed value
D_{HI}*	Highest displayed value ignoring decimal point
D_{LO}	Lowest displayed value
D_{LO}*	Lowest displayed value ignoring decimal point
P	Printed value
P_{HI}	Highest printed value
P_{LO}	Lowest printed value
REF	User defined reference value
REF*	User defined reference value ignoring decimal point

9. UNITS - When the UNITS key is pushed following the f key, the 2030A will print four special annotation characters in the four right hand printer columns, if they have been set (UN XXXX). The UNITS annotation overwrites the last four data columns. If the units function is reset, the 2030A will print units reset (UNITS RESET). To establish new units annotation characters, push the f key, then push the UNITS key. Refer to Table 2-2. Push the two or three digit code for the first annotation character, then press the - (minus) key; enter the second character code and press the - (minus) key; enter the third character code and press the - (minus) key; enter the fourth character code and press the - (minus) key; then press the ENTER key. To enter a blank space in place of any annotation character, press the minus key a second time instead of entering a character code. If the ENTER key is pushed after the first, second, or third character code, the remaining character(s) will be entered as blanks. To reset the units annotation, press f, then UNITS, then 0, then ENTER. Units annotation is applicable only to the test instrument selected through the special address.

10. SPEC ADR - When the SPEC ADR key is pushed following the f key, the 2030A will print the single digit special address (SA X). To establish a new special address, push key f, then key SPEC ADR, then push a single digit denoting the new special address, then push the ENTER key. The math, limits, trace print mode, and units functions apply only to the instrument input selected through SPEC ADR. To disable the special address function, push f, the SPEC ADR, the digit 0, then ENTER.

NOTE

Header information, limits, and both math constants are printed with leading zero suppression.

2-24. Math Function Error Calculation

2-25. Math function equation errors may be induced by rounding-off the A and B constants to the required six figures. These errors may be calculated as percentages of the printed value as detailed in Table 2-4. In calculating A constant round-off errors, the number of digits to the left of the decimal point (m) will always equal 4 in any trace mode calculation. In error calculation for deviation or percent deviation scaling, the highest printed value (Ph) is the highest expected deviation, or the highest expected percent of deviation. An error induced by the B constant is possible only if the lowest printed value (P1) is not equal to zero.

Table 2-3. Character Codes

CODE	CHAR	CODE	CHAR
32		69	E
33	!	70	F
34	"	71	G
35	#	72	H
36	$	73	I
37	%	74	J
38	&	75	K
39	'	76	L
40	(	77	M
41	)	78	N
42	*	79	O
43	+	80	P
44	,	81	Q
45	-	82	R
46	.	83	S
47	/	84	T
48	0	85	U
49	1	86	V
50	2	87	W
51	3	88	X
52	4	89	Y
53	5	90	Z
54	6	91	[
55	7	92	\
56	8	93	]
57	9	94	^
58	:	95	_
59	;	100	°
60	<	102	f
61	=	107	k
62	>	109	m
63	?	110	n
64	@	112	p
65	A	114	r
66	B	115	s
67	C	117	u
68	D	122	z

2-26. Print Mode Programming

2-27. As previously stated, there are two print modes which can be initiated using the f key. There are also four print modes which can be initiated without use of the f key. If any print mode other than CONT is in use, a new print mode may be initiated at any time. When a new print mode is initiated, the printer will stop scanning, print the word STOP, then start the selected new print mode. The following six print modes are possible:

1. SINGLE - When the SINGLE key is pushed, the 2030A scans all connected test instruments and prints the information supplied. The SINGLE key must be pressed again for each subsequent scan and

print sequence. The single print mode may also be initiated through the rear panel PRINT COMMAND connector. A negative-true logic signal or a relay closure to ground is required as input.

2. CONT - When the CONT key is pushed in, the 2030A scans all connected test instruments and prints the information supplied. Since the CONT key remains in until manually reset, the 2030A immediately initiates another scan and print sequence at the end of each preceding sequence. To terminate the continuous print mode, press and release the CONT key, setting it to the out position.

3. INTERVAL - When the INTERVAL key is pushed, the 2030A scans all test instruments connected, at the programmed time interval, and prints the information supplied. Header, interval time, and elapsed time or real time information is also printed when the INTERVAL mode is initiated. On succeeding prints, only interval time or real time is printed before the data. To terminate the interval print mode, press key f, then press the STOP key.

4. INT LIM - When the f key is pushed, followed by the INT LIM key, the interval and limit print mode is established. The 2030A scans all connected instruments and prints all information just as it does in the interval print mode. When the 2030A is not performing an interval print sequence, it monitors the instrument selected by SPEC ADR. If the SPEC ADR instrument information goes below the operator programmed low limit, or above the operator programmed high limit, the 2030A prints the instrument address, real time or elapsed time, and a symbol indicating which limit was crossed (< = low; > = high; space = return within limits) followed by the instrument data. Limits comparison is performed on the absolute numeric data value, ignoring the decimal point. If the math function is in use, limits comparison is performed after the math scaling, using the scaled data. The 2030A also prints the special address information when the information goes back within the programmed limits, but the symbol indicating which limit was exceeded is deleted. When a limit is exceeded, the 2030A supplies an alarm output at the rear panel LIMITS connector. When the input information goes back to a value within the limits, the alarm output is turned off.

NOTE

If no instrument, or a 2300 Scanner, is connected to the selected SPEC ADR input, or if a SPEC ADR of 0 is selected, the 2030A prints the words IMPROPER ENTRY followed by the SPEC ADR (bbbb X).

5. TRACE - When the TRACE key is pushed, the 2030A prints a dot trace, 100 dots wide, reflecting variations in input data from the instrument selected by SPEC ADR. The left trace edge is established by entering constant B; the trace span is established by entering constant A. (In TRACE, constant A must not have more than four decimal places. Five or six decimal place entries result in IMPROPER ENTRY when the TRACE key is pushed.) If the input information goes off scale, the 2030A supplies an alarm output at the rear panel LIMITS connector. It also prints one alphanumeric alarm printout which includes a symbol (< = left; > = right) that indicates the scale edge exceeded. When the input information returns on scale, the alarm output is turned off and an alphanumeric print out with no limit symbol occurs. TRACE dots are printed at 1 second intervals; an event marker is printed every sixtieth reading.

Table 2-4. Math Function Error Calculation

CONSTANT A ERROR	Percent error in P due to round-off error in constant A equals: $\frac{V-W}{A\ calculated}\ 100$ A Calculated: result of appropriate formula from Table 2-5. m: 6 minus number of digits to the left of the decimal point in the highest printed value. V: A Calculated $X10^m$ W: nearest whole number to V For proper decimal point placement, enter A constant = $\frac{W}{10^m}$
CONSTANT B ERROR	Percent error in P due to round-off error in constant B equals: $\frac{B\ constant - B\ calculated}{D^* - B\ calculated}\ 100$ B Calculated: result of appropriate formula from Table 2-5. B Constant: nearest whole number to B Calculated. D^*: Displayed value ignoring decimal point.

NOTE

If no instrument is connected to the selected SPEC ADR, the words IMPROPER ENTRY will be printed, followed by the SPEC ADR.

6. INT TRACE - When the f key is pushed, followed by the INT TRACE key, the interval trace print mode is established. The interval trace mode operates exactly as does the trace mode, but trace dots are printed only at the operator programmed time intervals. A timing mark is printed every 60 time intervals.

NOTE

If no instrument is connected to the selected SPEC ADR, the words IMPROPER ENTRY will be printed, followed by the SPEC ADR.

2-28. OPERATION

2-29. Use the following procedure to program and operate the Model 2030A Progammable Printer.

1. Press the POWER ON/OFF key. (See Table 2-5, Initialization Condition.)

Table 2-5. Initialization Condition

TIME:	Elapsed Time = 00:00:00
INTERVAL:	00:00:00
HEADER:	
A:	1.
B:	0
MATH:	Reset
HI LIM:	0
LO LIM:	0
UNITS:	Reset
SPEC ADR:	0
PRINT MODE:	Stop

NOTE

Pressing the PAPER ADVANCE key within 1 second of POWER ON initiates the printer self-test function. The 2030A will print a slash (/) in all columns if it is working properly.

2. Program the desired constants and functions by pressing key f, then the necessary function key, followed by the required value keys. (DECIMAL may be used only with key A; MINUS may be used with key B, HI LIM, LO LIM, or UNITS.) Press ENTER. (Refer to Figure 2-3, Programming Examples.)

NOTE

In programming UNITS, a maximum of three DIGITS may be selected for each of four UNIT codes. The MINUS key is the delimiter; it must be pressed at least once between each three DIGIT code group. Pressing MINUS twice produces a blank space in place of a UNITS annotation. Only one DIGIT may be selected for SPEC ADR.

3. If additional function and constants programming is necessary, repeat step 2.

4. If no additional function and constant programming is necessary, the TRACE, INTERVAL, CONT, or SINGLE print mode key may be pressed to select those print modes. Key f, followed by either INT TRACE or INT LIMIT may be pressed to program those print modes.

5. To program MATH, press key f, followed by the MATH key. If MATH is required, with INT TRACE, or INT LIMIT, press key f, then MATH, then ENTER. Press f again, then INT TRACE or INT LIMIT.

6. To terminate any print mode except CONT, press key f, then the STOP key. To terminate the CONT print mode, press the CONT key to reset it.

NOTE

When the STOP key is pressed or the CONT key reset, previously programmed constants are not reset. All constants are reset upon POWER OFF, or they may be reprogrammed at any time.

TIME = 12:34:56

PUSH	PRINTER RESPONSE
f	
TIME	RT 00:00:00
1	
2	
3	
4	
5	
6	
ENTER	RT 12:34:56

HEADER = 123456

PUSH	PRINTER RESPONSE
f	
HEADER	HD 000000
1	
2	
3	
4	
5	
6	
ENTER	HD 123456

INTERVAL = 00:01:30

PUSH	PRINTER RESPONSE
f	
INTERVAL	IT = 00:00:00
1	
3	
0	
ENTER	IT 00:01:30

A = 25.4

PUSH	PRINTER RESPONSE
f	
A	A 000000.
2	
5	
DECIMAL	
4	
ENTER	A25.4

Figure 2-3. Programming Examples

B = –123456

PUSH	PRINTER RESPONSE
f	
B	B 000000
–	
1	
2	
3	
4	
5	
6	
ENTER	B – 123456

LO LIM = –123456

PUSH	PRINTER RESPONSE
f	
LO LIM	LL 000000
1	
2	
3	
4	
5	
6	
–	
ENTER	LL –123456

HI LIMIT = –123456

PUSH	PRINTER RESPONSE
f	
HI LIM	HL 000000
1	
2	
3	
4	
5	
6	
–	
ENTER	HL –123456

UNITS = kHz

PUSH	PRINTER RESPONSE
f	
UNITS	UN UNITS RESET
1	
0	
7	
–	
7	
2	
–	
1	
2	
2	
ENTER	UN kHz

Figure 2-3. Programming Examples (cont)

MATH = SET/RESET

PUSH	PRINTER RESPONSE
f	
MATH	MATH SET OR MATH RESET

SPECIAL ADDRESS = 8

PUSH	PRINTER RESPONSE
f	
SPEC ADR	SA 0
8	
ENTER	SA 8

MATH OPERATION

MASTER EQUATION: P = A (D-B)

P: PRINTED OUTPUT

A: USER CONSTANT

B: USER CONSTANT

D*: DISPLAYED NUMERIC VALUE

TRACE EQUATION:

$$A = \frac{100}{D_{HI} - D_{LO}}$$

$$B = D_{LO}$$

DELTA EQUATION:

$$A = \frac{REF}{REF^*}$$

$$B = REF^*$$

% DELTA EQUATION:

$$A = \frac{100}{REF^*}$$

$$B = REF^*$$

SCALING EQUATION:

$$A = \frac{P_{HI} - P_{LO}}{D_{HI^*} - D_{LO^*}}$$

$$B = \frac{P_{HI} D_{LO^*} - P_{LO} D_{HI^*}}{P_{HI} - P_{LO}}$$

SCALING EQUATION, $P_{LO} = 0$:

$$A = \frac{P_{HI}}{D_{HI^*} - D_{LO}}$$

$$B = D_{LO^*}$$

*NUMERIC VALUE IGNORING DECIMAL POINT

STOP PRINT CYCLE

PUSH	PRINTER RESPONSE
f	
STOP	STOP

CLEAR TIME, UNITS, OR SPEC ADR

PRESS	PRINTER RESPONSE
f	
TIME	RT 12:34:56
0	
ENTER	ET 00:00:00
f	
UNITS	UN kHz
0	
ENTER	UNITS RESET
f	
SPEC ADR	SA 8
0	
ENTER	SA 0

Figure 2-3. Programming Examples (cont)

Section 3
Theory of Operation

3-1. INTRODUCTION

3-2. This section of the manual contains an overall functional description followed by a circuit analysis of the Model 2030A Programmable Printer. Simplified block diagrams and circuit diagrams are provided, as necessary, to supplement the text. Detailed schematics are available in Section 8 of this manual.

3-3. OVERALL FUNCTIONAL DESCRIPTION

3-4. The Model 2030A Programmable Printer receives information from a maximum of nine digital measurement instruments in the PTI data format (a unique Fluke format). The input information is thermally printed in one of six available print modes, and it may be manipulated using a scaling function and two operator established constants. The operator may also program any of nine additional parameters to place additional information on the printed paper record, or to control printing conditions. The printer will operate from any of three input voltages: 90 to 132V ac, 180 to 250V ac, or 12V dc. The ac input frequency must be between 47 Hz and 440 Hz. Two additional rear panel connectors provide an alarm output and connections for a remote PRINT COMMAND input.

3-5. Circuitry within the 2030A may be divided into five functional sections, as shown in Figure 3-1. The functional sections are: the PTI System Interface, the Keyboard Assembly, the Printer PCB, the printer mechanism, and the power supply. PTI format data enters the PTI System Interface, where it is converted to ASCII format data and transferred to the Printer PCB. The Keyboard Assembly provides operator control inputs to the PTI System Interface to establish the various print modes, parameters and functions. The Printer PCB decodes the input information and produces the proper control signals to initiate the correct printer mechanism output. The printer mechanism produces a thermally printed output of the data supplied through the other circuits. The power supply powers the printhead and all 2030A circuitry.

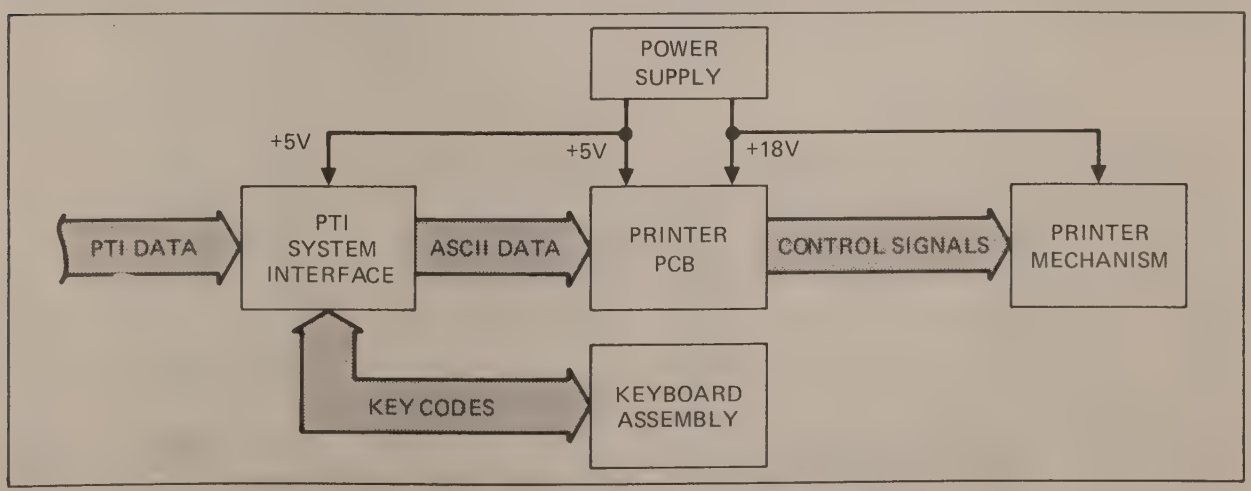


Figure 3-1. Model 2030A, Functional Sections

3-6. PTI System Interface

3-7. The PTI System Interface communicates with the digital test instruments supplying input data through a 36-pin Amp Champ Series connector. The printer connector is male. Connector pin assignments are listed in Table 3-1. Pins 1, 2, 7, and 8 carry signals used in data transfer. Pins 3, 4, 5, and 6 carry address signals from the printer to the test instruments (DOUs). Pins 9 through 16 are the data input pins. Pin 17 is common; pin 18 supplies +5V dc from the printer to the test instruments. Pins 19 through 36 are not used by the printer. Address and data signals are positive-true (≥3.5V dc), and handshake signals are negative-true (≤.7V dc). All signals are active-true,and signal levels are CMOS compatible.

3-8. The PTI System Interface, as shown in Figure 3-2, consists of seven functional groups of circuitry. Through these circuit sections, the PTI System Interface addresses up to nine input instruments, accepts either BCD or ASCII coded data in either a clocked (BCD) or handshake (ASCII) transfer mode, manipulates that data as directed by operator keyboard programming, and transfers bit-parallel, character-serial, ASCII data to the Printer PCB circuitry.

3-9. Data is received on eight data lines (D0-D7). They are tri-state lines through which the input test instruments supply data when they are addressed. These lines are enabled only when an input instrument receives a valid address. Input data format is instrument dependent. Refer to Table 3-2 and Figure 3-3.

3-10. Four address lines (A0-A3) allow multiple instrument inputs to one printer, and they are used by the printer to determine the type of instrument connected. Each input test instrument enables its data lines (D0-D7) only when it receives a valid address on the address lines.

3-11. DATA TRANSFER MODES

3-12. Data in the ASCII format is transferred using the handshake data transfer mode. Data in the BCD formats is transferred using the clocked data transfer mode. Handshake data transfer involves four control lines: Address Valid (ADRVL), Data Valid (DATVL), Data Acknowledge (DTACK), and Scan In Progress (SCNIP). Refer to Figure 3-4, Handshake Data Transfer Timing. When an input test instrument receives a valid address, it sends the ADRVL line low to indicate that it has been addressed. It then places valid data on the data lines (D0-D7) and sends the DATVL line low. The PTI System Interface reads and accepts the data, then sends the DTACK line low to inform the input instrument that the data has been received. A short time after DATVL goes high, DTACK will return high. This three line handshake sequence is repeated for each ASCII character transferred. The SCNIP line is used only when a Model 2300 Scanner is connected to the printer. When the printer addresses a scanner/instrument combination, SCNIP will go to a low logic state and remain low until all scanner channels have responded. Data transfer is complete when the PTI System Interface receives a 0A hex (ASCII line feed) code on the data lines.

3-13. Clocked mode data transfer requires no printer response during data transfer. The addressed test instrument places a BCD character on the data lines, then pulses the DATVL line once for each new character to be transferred. Data transfer in the clocked mode is terminated when the printer receives a specific number of BCD characters; the number of characters is determined by the instrument type. Refer to Figure 3-5, Clocked Data Transfer Timing.

3-14. BCD data is accepted in any of the four instrument dependent formats shown in Figure 3-3. Each group of Fluke instruments listed transfers BCD data using the clocked transfer mode.

Table 3-1. Connector Pin Assignments

PIN NUMBER	MNEMONIC	DESCRIPTION
1	$\overline{\text{ADRVL}}$	Address Valid
2	$\overline{\text{DATVL}}$	Data Valid
3	A0	Instrument Address, LSB
4	A1	Instrument Address, 2SB
5	A2	Instrument Address, 3SB
6	A3	Instrument Address, MSB
7	$\overline{\text{DTACK}}$	Data Acknowledge
8	$\overline{\text{SCNIP}}$	Scan In Progress
9	D0	Data Line LSB
10	D1	Data Line, 2SB
11	D2	Data Line, 3SB
12	D3	Data Line, 4SB
13	D4	Data Line, 5SB
14	D5	Data Line, 6SB
15	D6	Data Line, 7SB
16	D7	Data Line, MSB
17	GND	Common Return
18	+5	+5V dc, Supplied by printer
19-36		Not Used

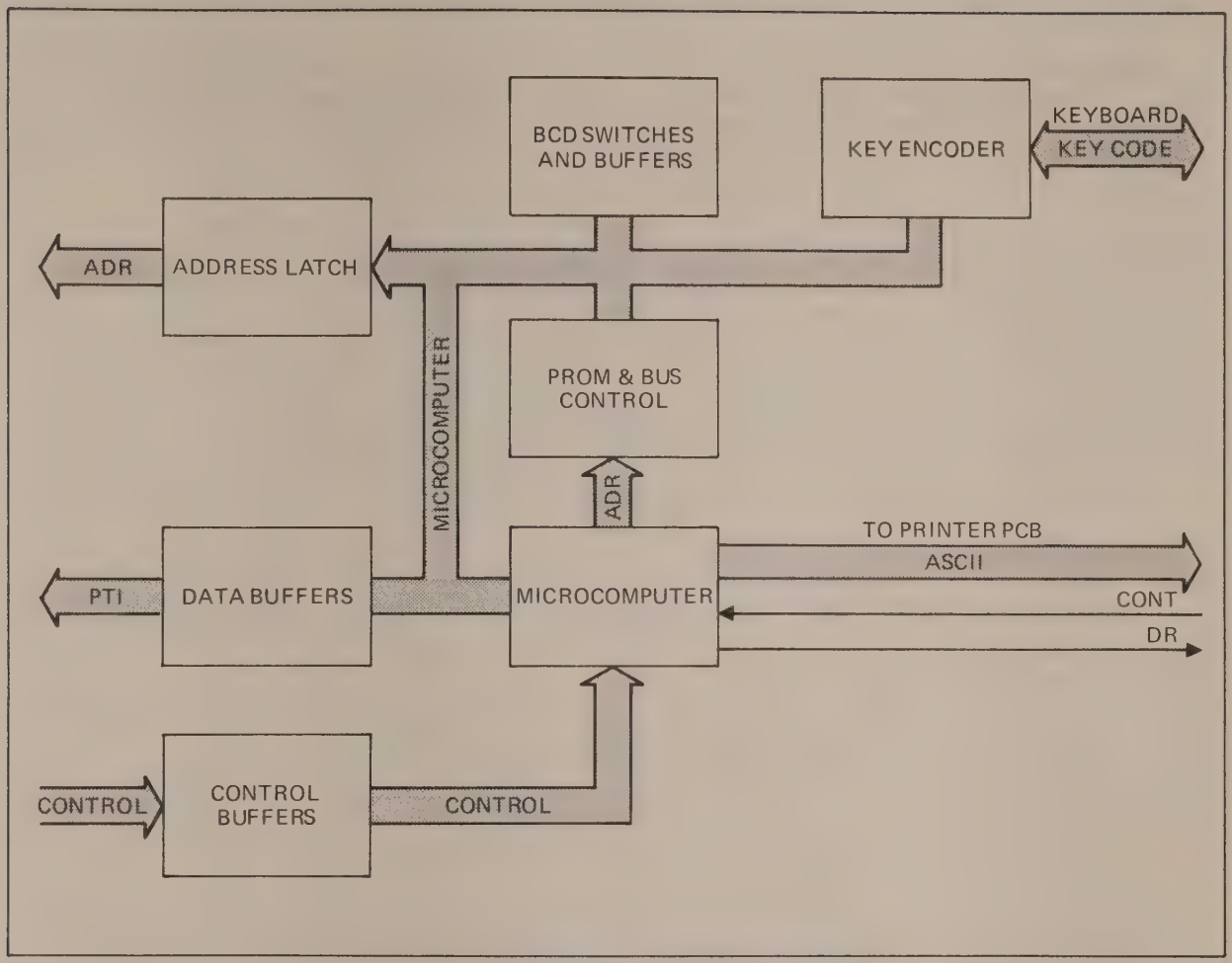


Figure 3-2. PTI System Interface, Functional Sections

Table 3-2. PTI System Interface Addresses

ADDRESS		DATA FORMAT	INTERFACE MODE
BINARY	HEX		
0000	0	None	PTI System Reset
0001	1	Parallel ASCII	Handshake
0010	2	7250A, 7260A, 7261A, W/521 Option	Clocked
0011	3	7220A W/521 Option	Clocked
0100	4	8920A W/521 Option	Clocked
0101	5	8600A, 8800A W/521 Option	Clocked
0110	6	Parallel ASCII	Handshake
0111	7	* Parallel ASCII	Handshake
1000	8	* Parallel ASCII	Handshake
1001	9	* Parallel ASCII	Handshake
1111	F	None	All Instruments Off

*Data formats and interface modes 1-9 are selectable on addresses 7-9.

(1) 7250, 7260, 7261 Counter Format

ORDER	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	SIGNIFICANCE
1	–	–	–	–	W	X	Y	Z	LSD
2	–	–	–	–	|	|	|	|	MSD
3	–	–	Hz	DP	|	|	|	|	2SD
4	–	–	s	|	|	|	|	|	3SD
5	–	–	ms	|	|	|	|	|	4SD
6	–	–	μs	|	|	|	|	|	5SD
7	–	–	kHz	|	|	|	|	|	6SD
8	–	–	MHz	DP	W	X	Y	Z	7SD

(2) 7220 Counter Format

ORDER	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	SIGNIFICANCE
1	–	–	–	–	W	X	Y	Z	LSD
2	–	–	–	–	|	|	|	|	MSD
3	–	–	–	–	|	|	|	|	2SD
4	–	–	Hz	DP	|	|	|	|	3SD
5	–	–	s	|	|	|	|	|	4SD
6	–	–	ms	|	|	|	|	|	5SD
7	–	–	μs	|	|	|	|	|	6SD
8	–	–	kHz	|	|	|	|	|	7SD
9	–	–	MHz	DP	W	X	Y	Z	8SD

(1) W, X, Y, Z represents a BCD value, with W = MSB, Z = LSB.
(2) DP, decimal point follows this digit when DP =1.

(3) 8600, 8800 Voltmeters

ORDER	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	SIGNIFICANCE
1	–	–	–	–	OVLD	a	b	c	Overload Range
2	–	–	–	–	W	X	Y	Z	3SD
3	–	–	–	–	POL	–	$\overline{POL}$	–	Polarity
4	–	–	–	–	Z	0	Z	$\overline{Z}$	MSD
5	–	–	–	–	W	X	Y	Z	2SD
6	–	–	–	–	W	X	Y	Z	5SD
7	–	–	–	–	W	X	Y	Z	LSD
8	–	–	–	–	W	X	Y	Z	4SD

(1) W, X, Y, Z represents a BCD value, with W = MSB, X = LSB.

Figure 3-3. BCD Data Formats

(4) 8920 Voltmeters

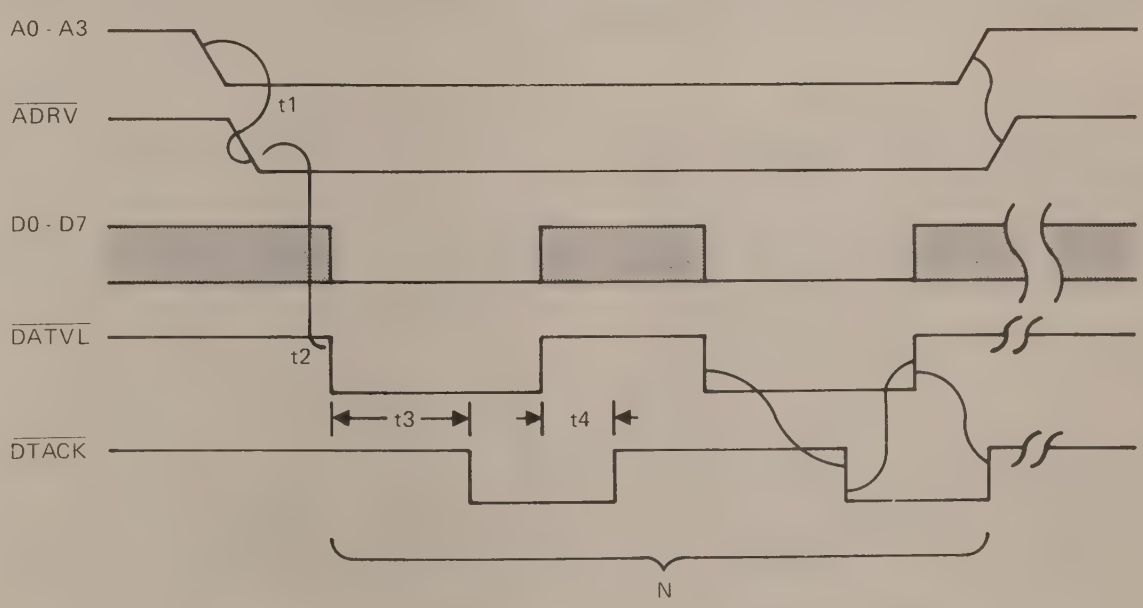
ORDER	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	SIGNIFICANCE
1	–	–	–	–	J′	L′	M′	N′	
2	–	–	–	–	K	a	b	c	
3	–	–	–	–	0	dB	OVLD	UNLD	
4	–	–	–	–	W	X	Y	Z	LSD
5	–	–	–	–	|	|	|	|	4SD
6	–	–	–	–	|	|	|	|	3SD
7	–	–	–	–	W	X	Y	Z	2SD
8	–	–	–	–	P–	1	0	Z	MSD

(1) W, X, Y, Z represents a BCD valued, with W = MSB, Z = LSB.
(2) dB = 1, instrument is in decibel mode.
(3) J′ = 1, instrument reading is 4 1/2 digits, when in linear mode.
(4) OVLD, reading is ⩾ max range.
(5) UNLD, reading is ⩽ 9% of range.
(6) a, b, c, – represents binary code range, a = MSB, c = LSB

(7)

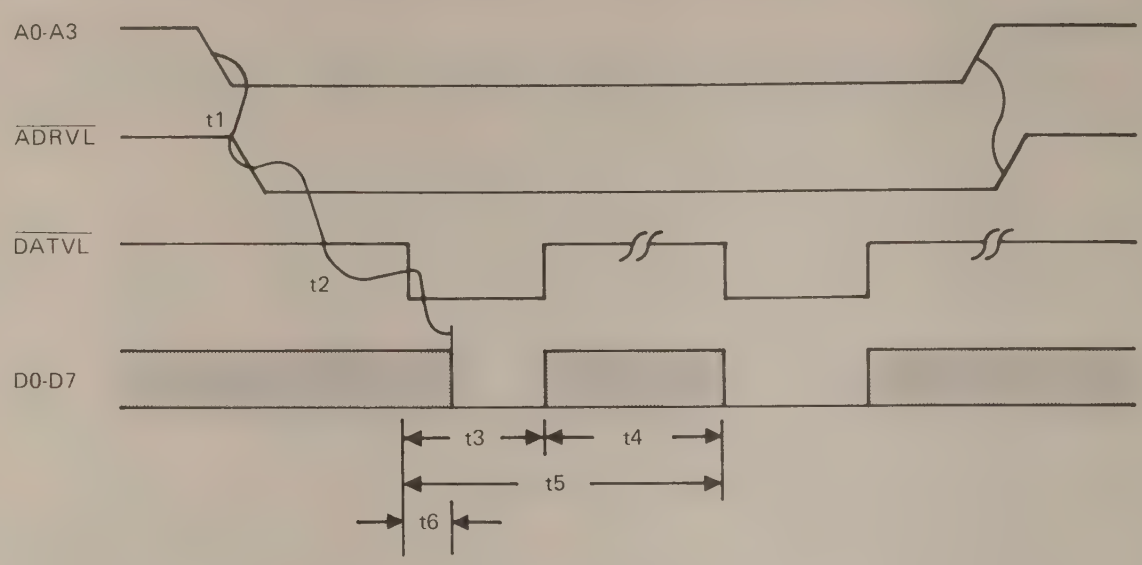
Connector Pin	Signal
9	DB0
10	DB1
11	DB2
12	DB3
13	DB4
14	DB5
15	DB6
16	DB7

Figure 3-3. BCD Data Formats (cont)



t1 = 5 μsec MAX
t2 = 0 μsec MIN
t3 = DATA VALID TO ACKNOWLEDGE ASSERTED (MAX .33 sec, MIN 35 μsec)
t4 = DATA VALID CLEARED TO ACKNOWLEDGE CLEARED (MAX 250 μsec, MIN 40 μsec)
N = NUMBER OF DATA BYTES

Figure 3-4. Handshake Data Transfer Timing



t1 = 5 μsec max
t2 = 0 μsec minimum
t3 = Data Valid Asserted (Minimum 40 μsec)
t4 = Data Valid Not Asserted (Minimum 20 μsec)
t5 = 80 μsec minimum
t6 = 15 μsec maximum

Figure 3-5. Clocked Data Transfer Timing

3-15. INSTRUMENT ADDRESSING

3-16. Nine instrument address binary codes are used to individually select each of nine possible test instrument inputs for data transfer. Address codes 1 through 6 are dedicated codes which require the data format and interface data transfer mode shown in Table 3-2. Address codes 7, 8, and 9 are normally ASCII data format and require the handshake data transfer mode. But these three addresses may also be set to any data format and transfer mode used in addresses 1 through 6. Three 4-pole, single-throw switches on the PTI System Interface allow selection of any of the nine available binary address codes for use on address numbers 7, 8, and 9. Switch S1 establishes the address code for address 7; switch S2 establishes the address code for address 8; switch S3 establishes the address code for address 9.

3-17. All connected instruments are polled in sequence when a polling sequence is initiated. Any print command initiates a polling sequence: a SINGLE print command initiates a single polling sequence, a CONT print command initiates continuous polling sequences until reset, and an INTERVAL print command initiates a single polling sequence at the selected interval. Each polling sequence starts at instrument address number 1. When address number 1 is placed on the PTI Bus, the printer waits 5 microseconds for a response from the test instrument (ADRVL = true). If ADRVL does not go true within the 5 microsecond period, a hex F code is placed on the address lines and the output address is incremented to address number 2. If ADRVL does go true, data is read in from the test instrument. If Scan In Progress (SCNIP) is true, prior to hex F being placed on the bus, the address is not updated after the reading, but is placed on the Address Bus repeatedly until SCNIP goes false. Each time data is read in, it is transformed as necessary, then printed out. After data transfer is complete, the next address is placed on the Address Bus and the process is repeated. An address update from 9 to 10, or a change in print mode will terminate a polling sequence. When the print mode is changed during a polling sequence, the instrument address will temporarily go to zero, then to hex F. The polling sequence will start again at address number 1 when the new print mode initiates polling.

3-18. KEYBOARD PROGRAMMING AND DATA CONTROL

3-19. Refer to Figure 3-2, PTI System Interface Functional Sections. Operator keyboard entries produce key encoder circuit outputs which initiate the proper PROM and microcomputer functions to produce the programming required. The microcomputer controls

addressing, programming, and data transfer in conjunction with the PROM. The data buffers and control buffers isolate the PTI System Interface Bus and microcomputer from the input test instruments. BCD data inputs are converted to ASCII before transfer to the Printer PCB.

3-20. Printer PCB Functional Description

3-21. Functionally, the 2030A Printer PCB may be separated into five sections, as shown in Figure 3-6. Digital input signals from a measurement instrument enter the PTI System Interface where they are processed and converted, as necessary, to produce digital information in the American Standard Code for Information Interchange (ASCII) format. Digital information, in ASCII, is transferred to the microcomputer control circuitry through a unidirectional bus. Under control of the resident program, the microcomputer control circuitry uses the information supplied to it to produce the required control signals for the voltage and current control circuitry. Voltage and current control circuitry switches power to the various printhead elements, in the order and at the time required, to produce thermally printed characters equivalent to the information displayed on the digital measurement instrument supplying the input. Power switched to the printhead elements is supplied by the +18V section of the power supply circuitry; power for the logic and control circuitry in the printer is supplied by the +5V power supply circuit.

3-22. MICROCOMPUTER CONTROL CIRCUITRY

3-23. Refer to Figure 3-7. Circuitry within the microcomputer control functional section includes a microcomputer, inverters, buffer drivers, and static shift registers. The microcomputer receives input information from the PTI System Interface through the bus at Port 0. After the microcomputer internally deciphers and manipulates the data, it supplies data outputs to buffer driver circuits on lines 2 through 7 of Port 1, and to the static shift registers and inverters through data lines 0 through 3 of Port 2. Port 2 data lines 4 through 7 directly control four segments of a Darlington transistor array to drive the print motor and advance the paper. Output lines 0 and 1 of Port 1 communicate with the PTI System Interface. Line 0 supplies anAcknowledge (ACK) signal indicating that data has been received. Line 1 of Port 1 supplies a signal (PRINTING) indicating that the printer is currently printing information received and cannot receive additional data. The microcomputer receives a Data Ready (DR) input from the PTI System Interface. If the microcomputer is not, at present, printing previously received information, it responds with an Acknowledge (ACK) true signal to handshake data in. Although the microcomputer has received the data, it will not print that data unless the PRINT line is low when an ASCII Line Feed character, indicating the end of a data string, is handshaked in by the DR and ACK lines.

3-24. Microcomputer outputs from Port 1 and Port 2 are data inputs to the buffer drivers (Port 1, lines 2-7), inverters, and static shift registers (Port 2, lines 0-3). Port 2 (lines 4-7) also provides print motor control through four segments of an eight-segment Darlington transistor array.

3-25. Output line 2 of Port 1, through a buffer driver, controls a Darlington transistor which acts as an on-off switch for the positive 18 volt supply to the paper advance motor and dot selection Darlington transistors. Port 1, output lines 3 through 7, through buffer drivers, controls five Darlington transistors to supply printhead Dot Select (DS) voltage.

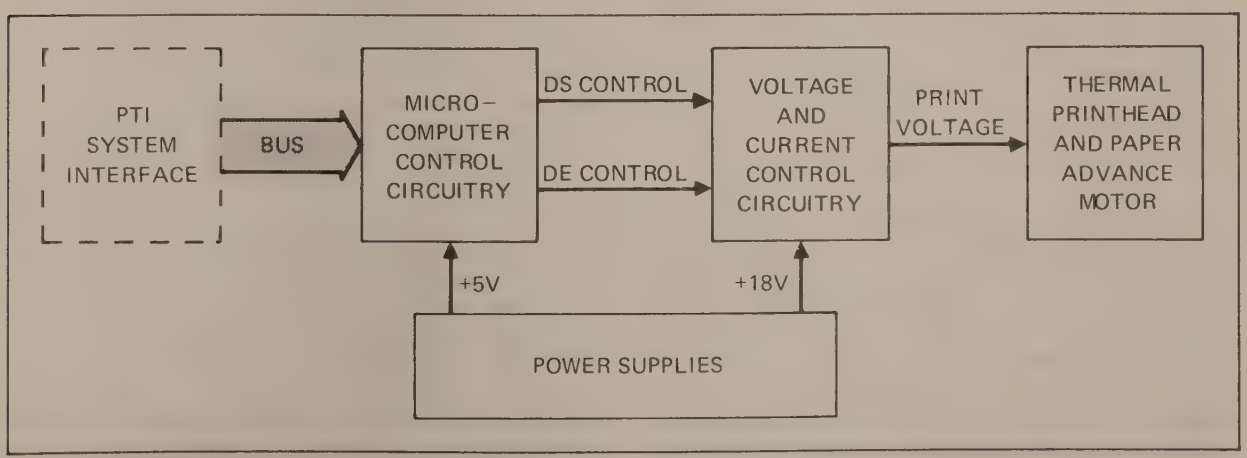


Figure 3-6. Printer PCB Functional Sections

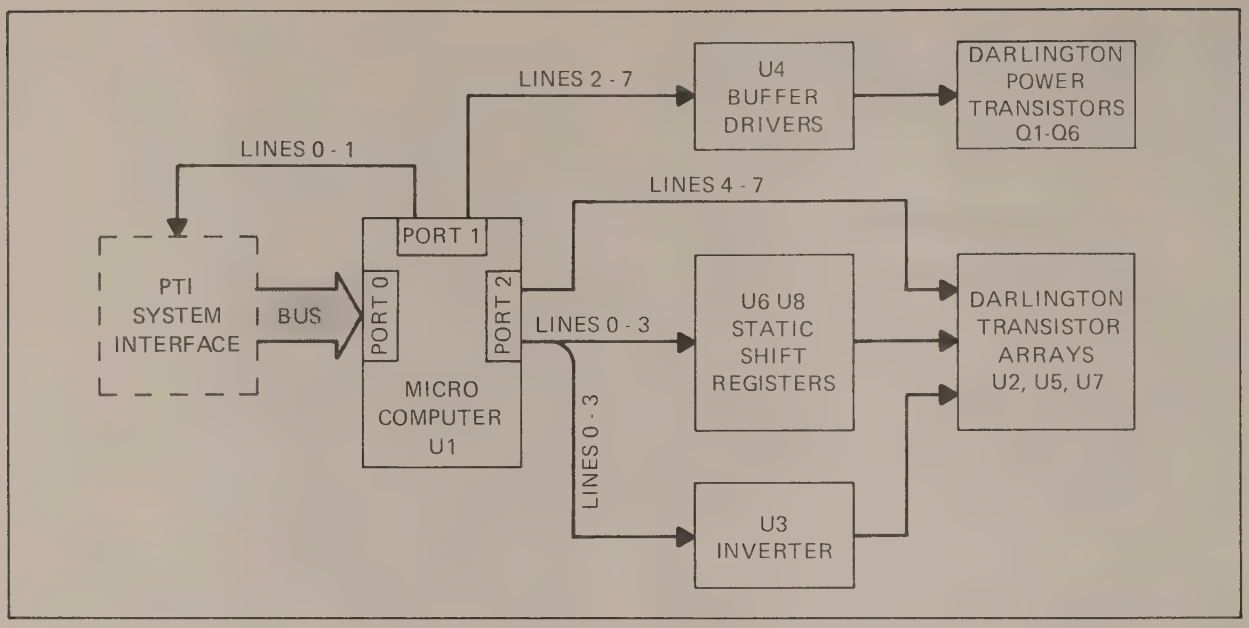


Figure 3-7. Printer PCB Simplified Block Diagram

NOTE

The Darlington transistor switch (controlled by Port 1, line 2) is turned on 1 second after power on and remains on until the 2030A is turned off.

3-26. Output lines 0 through 3 of Port 2, through inverters, control four segments of an eight-segment Darlington transistor array to provide four Digit Enable (DE) inputs to the printhead. Port 2 data lines 0 through 3 also provide an additional 16 DE inputs to the printhead through two dual 4-bit static shift registers. The shift registers are used as an I/O expander for Port 2 data lines 0 through 3, allowing these four data lines to produce 16 control bits for 16 Darlington transistor segments in three Darlington transistor arrays. An output strobe from the microcomputer clocks the data bits in and out of the shift registers. The 20 control bits provided through the inverters and shift registers control 20 Darlington transistor segments to produce 20 Digit Enable (DE) outputs for the printhead.

3-27. VOLTAGE AND CURRENT CONTROL

3-28. When the PRINT line is low, data read into the microcomputer is transformed into control data bits, and the control data bits are placed on Port 1 and Port 2 data lines. Port 1 data lines 3 thorugh 7, through the buffer drivers, control five discrete Darlington power transistors. The power transistors switch power to five Dot Select (DS) bus lines on the thermal printhead. Refer to Figure 3-8. Each Dot Select Bus receives positive 18 volts from the power supply when the power transistors, at the direction of the microcomputer, supply that power.

3-29. As shown in Figure 3-8, corresponding print dots in all 20 printhead digits receive power when the bus that connects them receives power. Although all corresponding dots receive power, only those dots that also have a return path will be enabled. Return paths for print dot power are supplied through three, eight-segment Darlington transistor arrays, controlled by the microcomputer by way of the inverters and shift registers. These transistors are switched on and off individually to enable each digit in the printhead.

3-30. THERMAL PRINTHEAD AND PAPER ADVANCE MOTOR

3-31. To produce an alphanumeric character, the printhead requires Dot Select inputs (one or more) and at least one Digit Enable input. These inputs allow one or more print dots to heat and, thereby, produce an impression on the printer paper. The characters are printed in a five column (horizontal) by seven row (vertical) dot matrix. Refer to Figure 3-9. The vertical matrix dimension is obtained by advancing the printer paper in precise steps. Port 2 data lines 4 through 7, from the microcomputer, control four segments of an eight-segment Darlington transistor array to provide return paths for power supplied through a discrete Darlington transistor controlled by Port 1, line 2 and one of five discrete Darlington transistors controlled by Port 1 lines 3 through 7. The return path Darlington transistors, controlled by Port 2 lines 4 through 7, are turned on and off in a microcomputer controlled sequence to achieve precise 7½° motor-rotation steps between print dot rows within the character matrix.

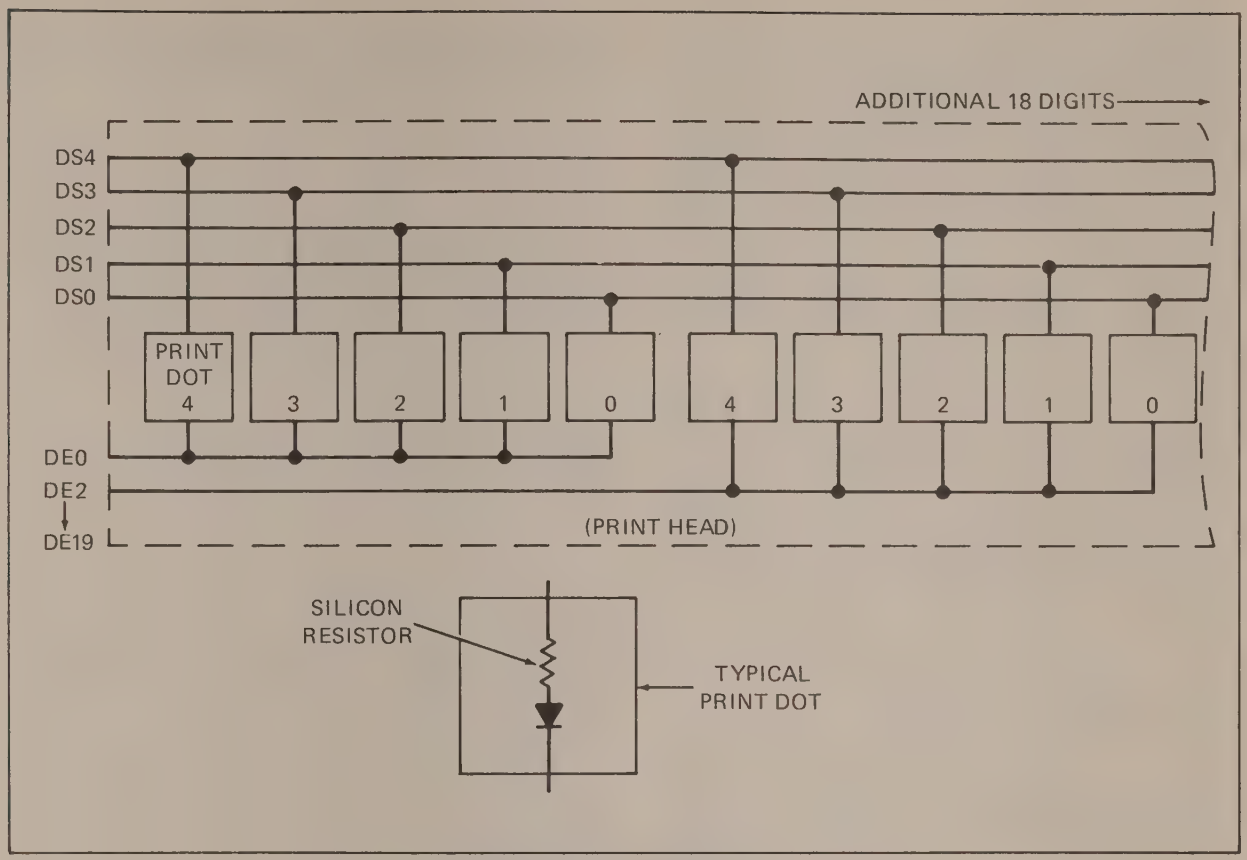


Figure 3-8. Printhead Configuration

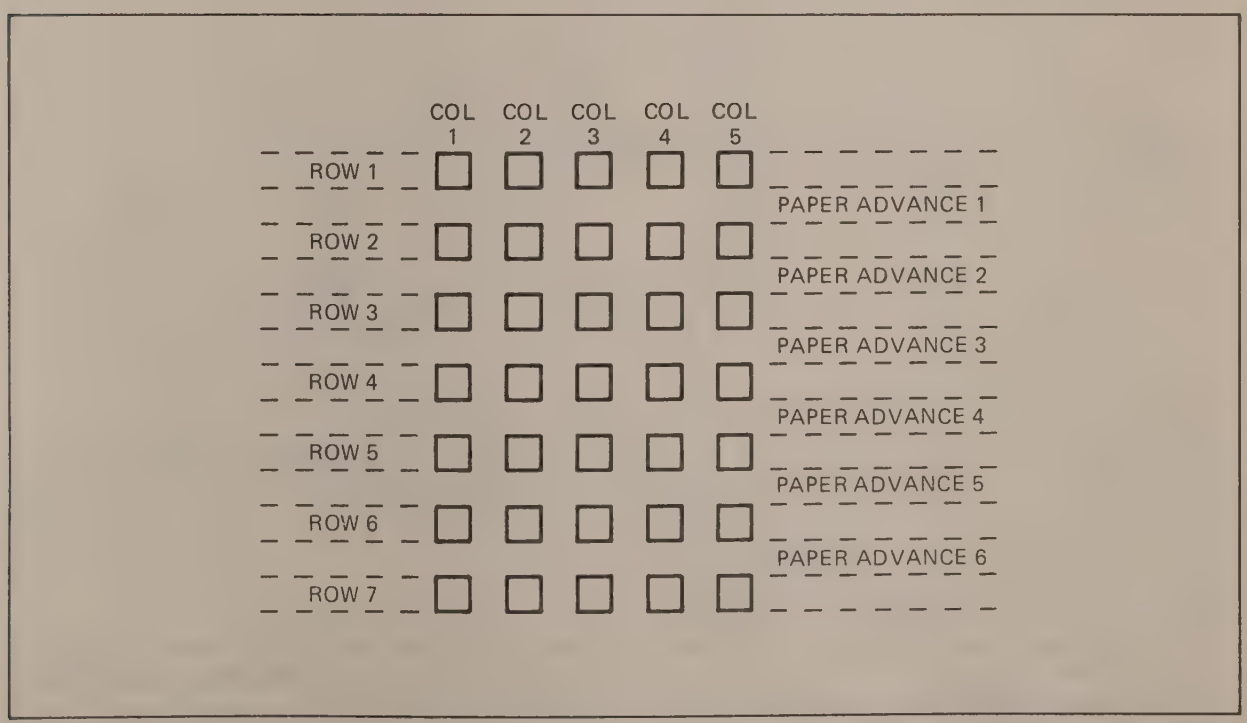


Figure 3-9. Alphanumeric Dot Matrix

3-32. POWER SUPPLIES

3-33. Model 2030A power supply circuitry may be viewed as two functional units; one unit supplies +5V dc to power the logic elements, and the other unit supplies +18V dc to power the thermal printhead and paper advance motor. A thermistor located near the thermal printhead regulates the +18V dc output to compensate for varying power requirements as the printhead warms and cools. This thermistor compensation maintains uniform character tones, or degree of darkness, through a wide range of ambient conditions.

3-34. The power supply section receives either ac or dc input power. The ac input power may be either 90 to 132 volts, or 180 to 250 volts, depending on the position of input power selector switch, S5. The dc power input must be +11 to +15 volts. If both +12V dc and an ac input are present, the power supply circuitry will operate from the ac supply. If the ac supply should fail, the power supply switches automatically to dc operation without interruption.

3-35. BLOCK DIAGRAM ANALYSIS

3-36. PTI System Interface

3-37. The PTI System Interface, comprised of the seven functional circuit sections shown in Figure 3-2, interfaces the Printer PCB to the PTI Bus. It also contains all special function programming and data transformation tables. These functions are performed by the circuitry represented in Figure 3-10, the PTI System Interface Block Diagram.

3-38. Data is received through a group of eight data buffers in either a handshake or clocked transfer mode. All handshake control signals and all address lines are also buffered. Three BCD address switches and buffers provide a means of setting addresses 7, 8, and 9 to receive data in any format used on addresses 1 through 6. The microcomputer and PROM, in combination, contain all data transfer, transformation, and special function programming. The key encoder supplies operator programming inputs to direct special functions.

3-39. A polling sequence of all instruments connected to the input bus is initiated when the microcomputer receives a single print command or a continuous print command from the front panel switches, or when an interval print command is generated at the direction of front panel programming. Interval print is an internal microcomputer function. Single print or interval print initiates a single polling sequence; a continuous print input initiates continuous polling sequences until the CONT PRINT front panel switch is manually reset.

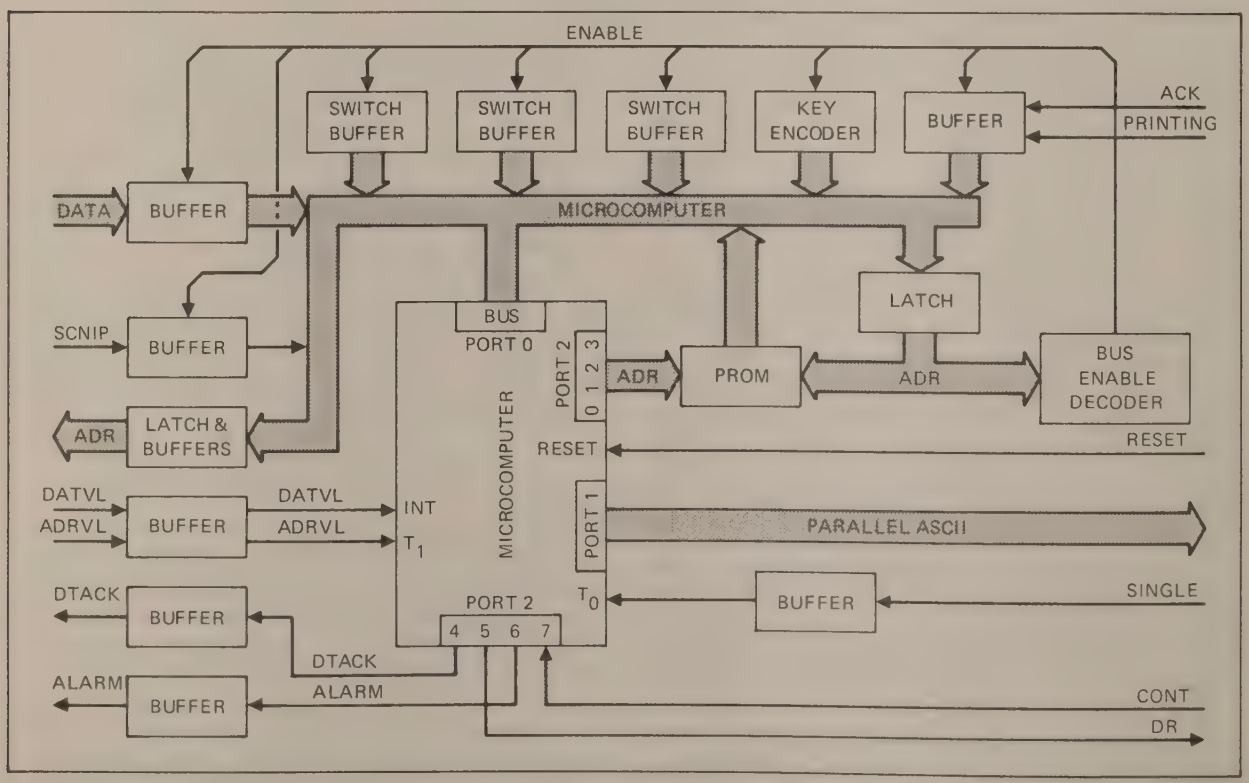


Figure 3-10. PTI System Interface Block Diagram

3-40. When any print input initiates a polling sequence, the microcomputer sends address number 1 through the internal bus to the address latch. The address is sent out on the address lines. If a test instrument is present at address 1, it will send the Address Valid (ADRVL) line low (true) within 5 μs. Data is then read in through the data buffers. If a scanner is present at an address, the Scan In Progress line (SCNIP) will go low (true) and the microcomputer will repeat that address until SCNIP returns high (false). If the ADRVL line remains high (false) more than 5 μs after the address is sent, the microcomputer increments to the next address (address 2) and sends it.

3-41. When ADRVL goes true and data is read in, the microcomputer transforms the data to ASCII, if required, and manipulates the input data as directed by front panel programming. Front panel programming data is placed on the bus through the key encoder. Active low signals generated within the key encoder are routed to the keyboard through J3. Refer to Figure 3-11. Connector pins 5, 6, 7, and 8 are keyboard inputs from the key encoder. Pins 1, 2, 3, and 4 are outputs to the key encoder. As shown in Figure 3-11, pushing any key will result in a unique X input-Y output, combination. The keyboard Y outputs are routed back to the key encoder, where they are decoded to produce a 4-bit BCD output to the microcomputer. Each of the 16 possible X input-Y output keyboard combinations produces a different key encoder output. The 4-bit BCD key encoder output is placed on the bus when the bus enable decoder, under microcomputer control, enables the key encoder.

3-42. Three additional 4-bit BCD codes may be placed on the bus when the bus enable decoder selects them. These three BCD codes set addresses 7, 8, and 9 to accept data in any format used on addresses 1 through 6. Each circuit contains a switch with four individual segments and a buffer for each switch segment. The first switch (S1) selects the format for use on address 7; the second switch (S2) selects format for address 8; the third switch (S3) selects format for address 9. If all switch segments on one switch are open (BCD-0000), the address controlled by that switch will accept data in the format shown in Table 3-1. To enable addresses 7, 8, and 9 to accept data in formats 1 through 6, simply set the appropriate switch to BCD code 1, 2, 3, 4, 5, or 6. Switch segment P1 on all switches is the most significant digit. A switch segment closed equals a logic 1; a switch segment open equals a logic 0. Any invalid switch code (0000 or any address above BCD 9) will be ignored.

3-43. Terminal block TB1, mounted at the rear of the PTI System Interface, contains two screw-terminal connections for a user-supplied, external alarm device. In the interval limits operating mode, when the input data exceeds the high limit or falls below the low limit, the microcomputer supplies an alarm signal to a transistor. the transistor acts as a switch. When the microcomputer supplies the necessary alarm signal, the transistor switches on to supply digital common at pin 1 of TB1. Since pin 2 of TB1 is connected to common, the alarm output at TB1 is a simple switch closure which the user may connect to an external alarm device.

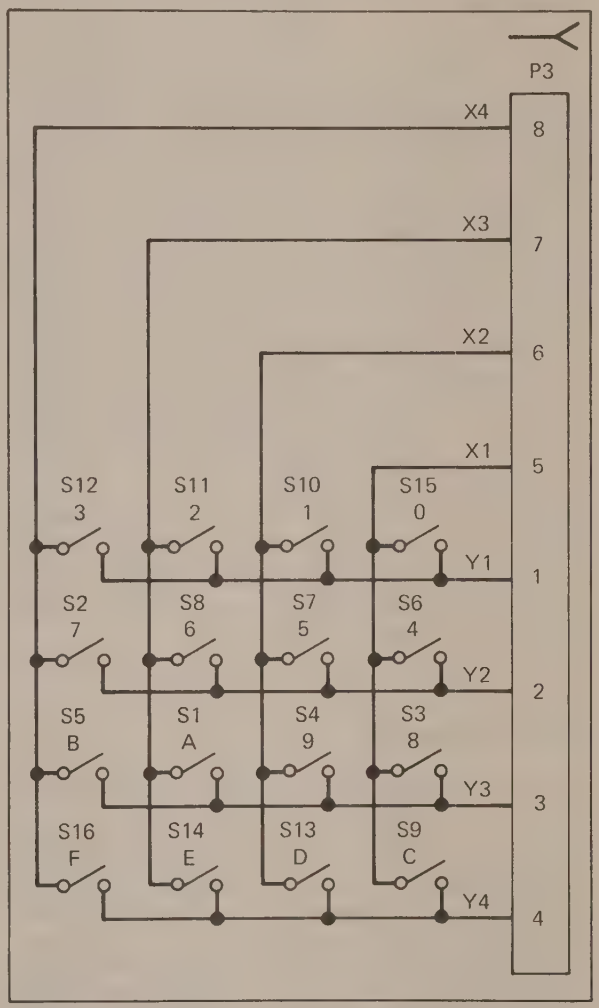


Figure 3-11. Keyboard Schematic

3-44. Data Transfer Sequence

3-45. After performing all operator programmed data manipulation and transforming the input data to ASCII, the PTI System Interface microcomputer initiates data transfer to the Printer PCB microcomputer. When the PTI System Interface microcomputer has valid ASCII data ready on its output lines (Port 1, 0-7), it sends the Data Ready (DR) line to a low logic level ($\leq$.7V). The microcomputer in the PTI System Interface can set DR low only if the Printer PCB microcomputer has set both Acknowledge (ACK) and PRINTING lines high (false)

indicating it is ready to receive data. When DR goes low, data is transferred from the PTI System Interface microcomputer to the Printer PCB microcomputer. The Printer PCB microcomputer sets ACK low when it receives data. When ACK goes low (≤.7V), the PTI System Interface microcomputer sets DR high (≥3.5V). The ACK line will remain low a short time after DR returns high.

3-46. Within the PTI System Interface, the PRINT line is connected to ground, thus maintaining a low logic PRINT command to the Printer PCB microcomputer. However, the Printer PCB microcomputer will not initiate a print sequence until it receives an ASCII Line Feed input from the PTI System Interface microcomputer, through the data lines. Refer to Figure 3-12, the Printer PCB Block Diagram. A low logic SINGLE or CONT print command may be generated through the SINGLE PRINT or CONT PRINT front panel pushbutton. A low logic SINGLE print command may also be generated through an external switch closure. Refer to the PTI System Interface Block Diagram, Figure 3-10. When the PTI System Interface microcomputer receives a low logic SINGLE or CONT print command, or when an interval print command is generated internally, the PTI System Interface microcomputer places an ASCII Line Feed code on the data lines at the end of the data string. The Printer PCB microcomputer then directs Printer PCB circuitry to produce a printed output representing the data received.

3-47. Printer PCB

3-48. MICROCOMPUTER CONTROL CIRCUIT

3-49. Model 2030A Programmable Printer timing and control functions are performed by a single-chip, 8-bit microcomputer. It contains all necessary memory, programming, processing, timing, and I/O functions. One external component is required in the microcomputer circuit: a clock crystal to establish clock frequency. Refer to Figure 3-12, the Printer PCB Block Diagram.

3-50. The program resident in the microcomputer read-only-memory (ROM) directs internal data processing to produce microcomputer outputs representative of the input data. Data outputs from Port 1, lines 2 through 7, control power switching to the paper advance motor and printhead busses. Lines 0 through 3 of Port 2, through the shift registers and inverters, control the digit enable transistor arrays to provide return paths for printhead power. A microcomputer strobe, from the PROG line, strobes data from lines 0 through 3 of Port 2 into the shift registers. Lines 4 through 7 of Port 2 directly control return paths for the paper advance motor coils.

3-51. PAPER ADVANCE MOTOR CIRCUIT

3-52. Microcomputer output line 2 of Port 1, controls power to the paper advance motor through a buffer driver and a discrete Darlington transistor. The buffer driver isolates the microcomputer from the Darlington transistor and provides sufficient signal strength to turn on the transistor. The motor power Darlington transistor, when it is switched on through the buffer driver, switches +18V dc (from the power supply) to four stepper motor coils, and to five additional Darlington transistors in the dot select circuit. Although +18V is present at one side of the motor coils, the motor will rotate only when power return paths are supplied through four segments of an eight-segment Darlington transistor array. The microcomputer turns on the return path transistors in a step sequence to rotate the paper advance motor in 7½° steps. The 7½° steps produce a seven-row dot matrix to print character lines. Refer to Figure 3-9. The operator can initiate a continuous paper advance by pressing switch S4. The switch supplies a low logic level at microcomputer input T1; the microcomputer then supplies a continuous sequence of signals to the motor power return transistor.

3-53. DOT SELECT CIRCUIT

3-54. To produce a five column by seven row character dot matrix, the paper advance motor rotates 7½° for each dot row, and each printhead character contains five print dots. Print-dot power is available to the print dot Darlington transistors only when the +18V power transistor is on. Refer to Figure 3-13. Microcomputer output signals on lines 3 through 7 of Port 1, through buffer drivers, switch five Darlington transistors on and off to supply +18V to the five printhead Print Dot Busses. Corresponding print dots in all 20 printhead digits are bussed, so they all receive power when the appropriate bus receives power. Only the print dots in a digit that has received a Digit Enable input will print. Refer to Figure 3-8.

3-55. DIGIT ENABLE CIRCUIT

3-56. The digit enable circuit determines which digits of the 20 on the printhead will print a specific print dot when that Dot Bus receives power. Digit Enable and Dot Select inputs must be coincident for a dot to print.

3-57. Microcomputer Port 2, lines 0 through 3, controls and initiates Digit Enable commands. Lines 0 through 3 are inputs to four inverters and two dual 4-bit shift registers. Through the inverters, data outputs on lines 0 through 3 directly control four Darlington transistor segments of an eight-segment Darlington array to supply Digit Enable inputs to four of the 20 printhead digits. High logic levels from the microcomputer are inverted

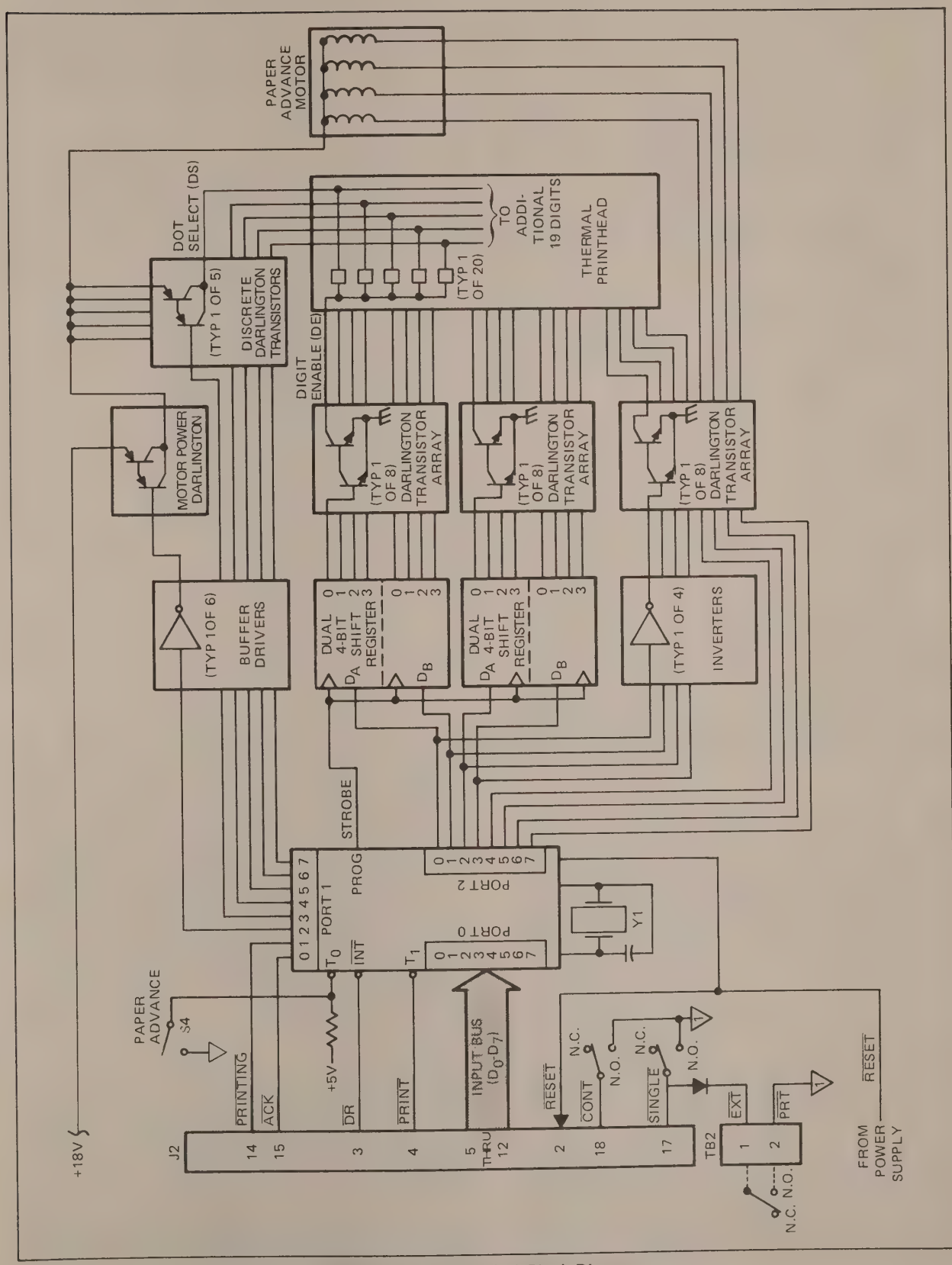


Figure 3-12. Printer PCB Block Diagram

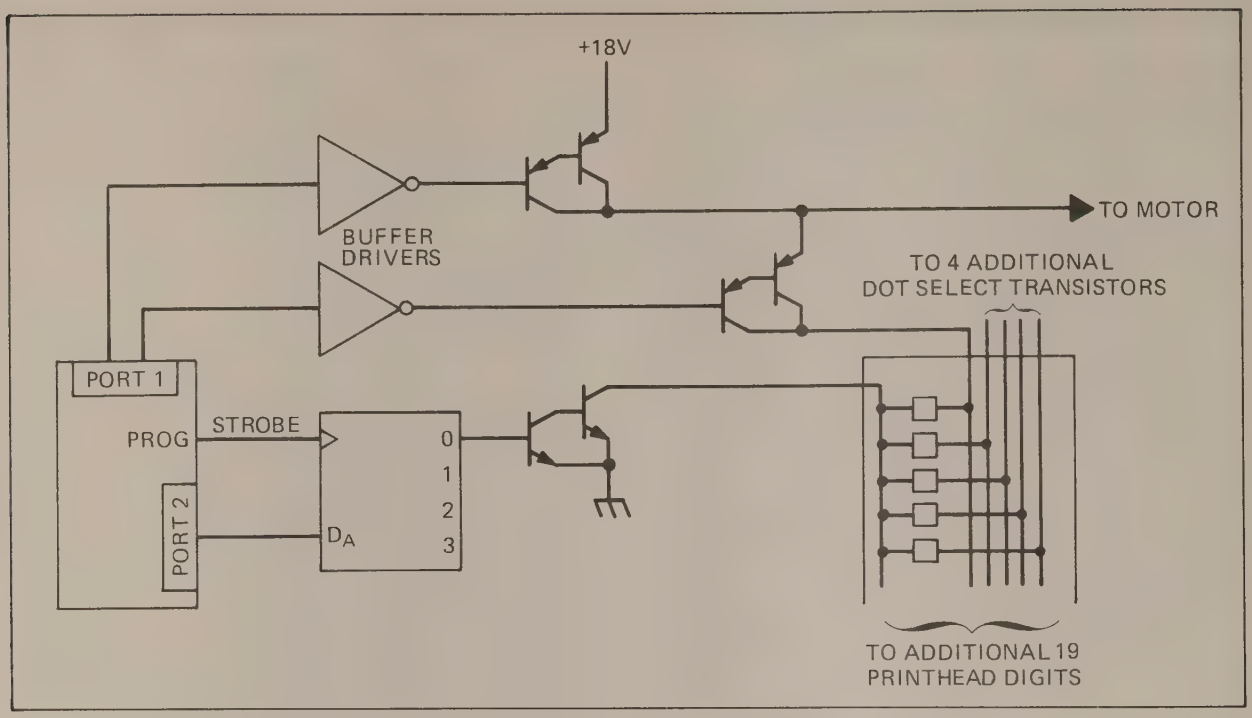


Figure 3-13. Dot Print Simplified Schematic

and applied to the Darlington transistor arrays. When a transistor segment conducts, it effectively supplies a common return on the Digit Enable (DE) line to that printhead digit. If +18V is available on any Print Dot Bus, current flow will produce heat in that print dot and the dot will produce an image on the paper. Digits 16, 17, 18, and 19 are controlled through the inverters and the Darlington transistor segments they control.

3-58. The remaining 16 digits on the 20-digit thermal printhead are also controlled by Port 2, lines 0 through 3, but the control signals are strobed through two dual 4-bit static shift registers. The shift registers are used as output bus expanders; they provide four output signals for each input line. A strobe pulse from the microcomputer provides clocked (synchronous) shift register operation.

3-59. Data from the microcomputer is transferred into the shift registers in a serial manner; each bit of input data is shifted from one stage to the next during the positive-going strobe pulse transition. One data bit in, then may enable any of four different digits, depending upon its position in the shift register.

3-60 A shift register output enables 1 of 16 Darlington transistor circuits; the enabled Darlington circuit supplies power common to 1 of 16 digit segments on the printhead. The remaining four printhead digit segments are controlled through the inverters and four additional Darlington transistor circuits.

3-61. POWER SUPPLY

3-62. Positive 5 Volt Power Supply

3-63. Line ac voltage, through connector J11 and fuse F1, is switched (S1) to an ac power transformer (T1). An additional switch (S5), provides input voltage range selection, either 90 to 132V ac, or 180 to 250V ac. The ac input is bridge rectified, then filtered to supply a dc input to both the +5 volt supply and the +18 volt power supply circuitry. Direct dc power may be supplied through a rear panel connector. The dc input power is fused, switched, and supplied to the same point as the rectified and filtered ac input. The dc input voltage range is from positive 11 to 15 volts dc; and the input dc supply must be capable of supplying 8 amps peak current for 2 ms of each 8 ms during a print cycle. Refer to Figure 3-14, Power Supply Simplified Block Diagram.

3-64. Refer to Figure 3-15, +5 Volt Power Supply Simplified Schematic. Input voltage VA, supplied through the transformer, bridge, and filter, or directly through the dc input and switch, goes to a switch circuit in the +5 volt power supply. The switch circuit is composed of two transistors (Q7, Q8) and associated circuitry. A Pulse Width Modulator (PWM) control chip (U9), a filter, and a voltage divider network form the remainder of the +5 volt power supply circuit.

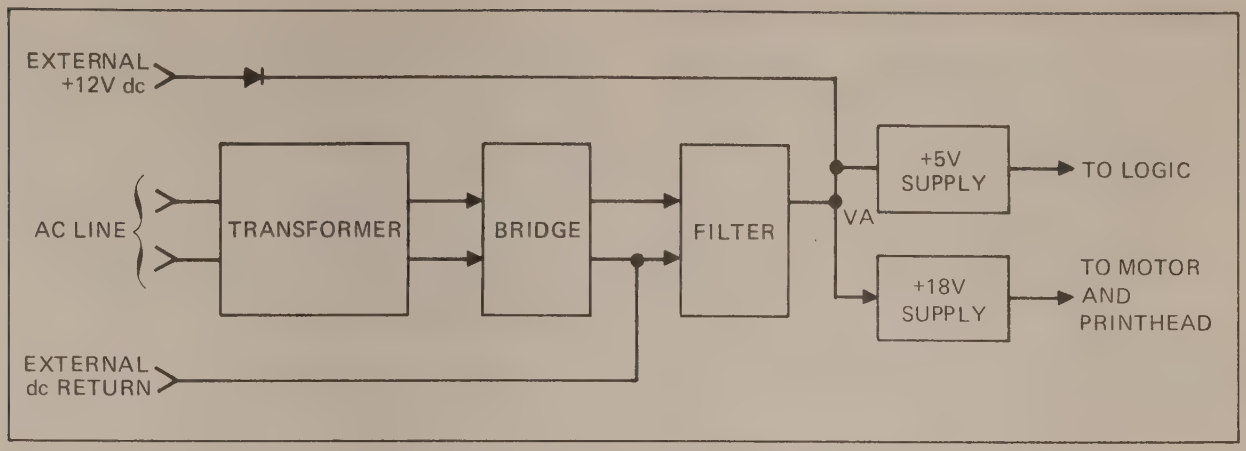


Figure 3-14. Power Supply Simplified Block Diagram

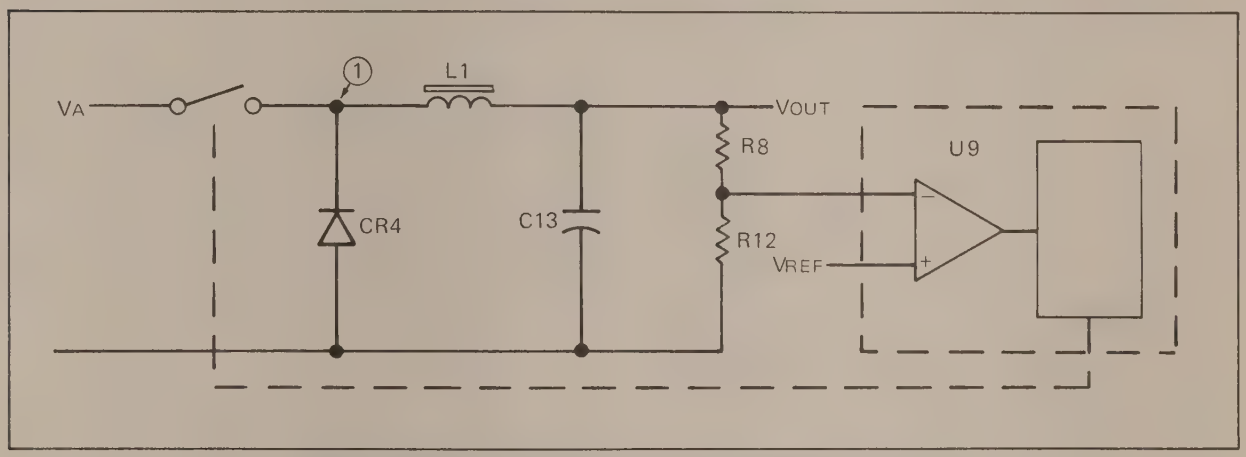


Figure 3-15. Positive 5 Volt Power Supply Simplified Schematic

3-65. Voltage out of the switch circuit, through the filter, is scaled by the voltage divider network (R8, R12) and supplied as an input to an error amplifier within the PWM chip (U9). The error amplifier compares the scaled output voltage to a fixed reference voltage (2.5V) and produces an output representative of the difference. Error amplifier output controls the pulse width modulator, which, in turn, controls the amount of time the switch circuit remains on.

3-66. Refer to Figure 3-16, Positive 5 Volt Power Supply Typical Switch Circuit Times. Voltage out (Vout) is the average value of the square wave produced at the switch circuit output (Figure 3-15, point 1). Total time (T) is fixed at approximately 25 μs by the pulse width modulator circuit frequency. As the error amplifier detects a rise in Vout, compared to Vref, the error amplifier output decreases, decreasing the percentage of total time (T) the PWM keeps the switch circuit on (Tc). This lowers the percentage of time (T) that voltage in (VA) is allowed to pass, thus lowering the average voltage out (Vout). This relationship may be expressed mathematically as : $Vout = VA\ Tc/T$.

3-67. As indicated by both the formula and Figure 3-16, a wide range of input voltages (VA) can be regulated to positive 5 volts by varying the percentage of total time (T) that the switch circuit remains on (Tc). A dc average of the switch circuit square wave is obtained through the filtering provided by coil L1 and capacitor C13.

3-68. Positive 18 Volt Power Supply

3-69. The positive 18 volt power supply is a step-up, pulse width modulated regulator. Input voltage (VA) is stepped-up and regulated at 18 volts through an error amplifier, comparator, switch circuit, coil, and capacitor. Two inputs are required in addition to input voltage: reference voltage (Vref) and a +1.5 to +3.5 volt sawtooth waveform. Reference voltage is supplied by the reference voltage regulator (U10) and the sawtooth waveform is supplied by the 5 volt power supply pulse width modulator (U9).

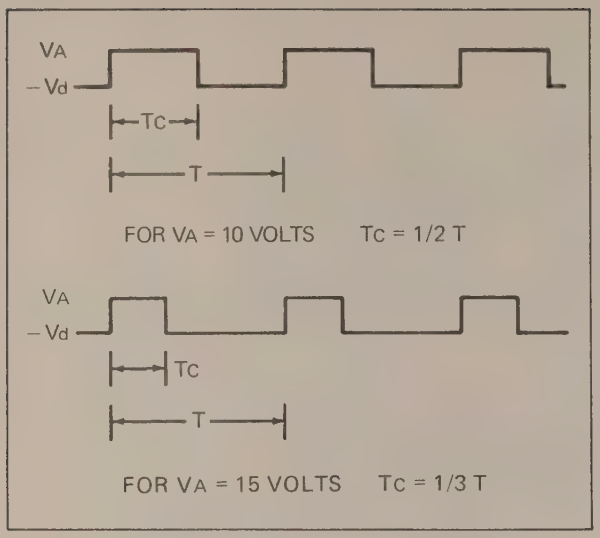


Figure 3-16. Positive 5 Volt Power Supply, Typical Switch Circuit Times

3-70. Refer to the Positive 18 Volt Power Supply Simplified Schematic, Figure 3-17. Assuming that the output voltage (Vout) has decreased below the desired level, the error amplifier output, due to the increased difference between the scaled Vout input and the reference voltage, will become more positive. As the error voltage into the comparator becomes more positive, the comparator output will remain cutoff longer because the sawtooth waveform must increase to a higher level before an output is produced. A longer period with no output from the comparator allows the switch circuit (Q10, Q11) to remain on longer, thus allowing inductor L2 to store more energy. While the switch circuit is on, output power is supplied by capacitor C22. When the comparator turns off the switch circuit, the collapsing field around L2 releases energy which is stored in capacitor C22 and supplied to the load. (Refer to Figure 3-18 for typical waveforms.)

3-71. Output voltage may be calculated using the formula Vout = Va (1 + Tc/To), where Tc is the time the switch is on and To is the time the switch is off. Vout may also be calculated as follows:

$$Vout = Vref\left[1 + \frac{(R16 + RT)}{R18}\right]$$

3-72. In the voltage divider resistor string which supplies input voltage to the comparator (U12), RT is shown as a variable resistor. The variation in total resistance is induced by a thermistor mounted on the thermal printhead. Printhead temperature varies due to many operating conditions, including the number of characters printed per line, and the selected print mode (single or continuous). The thermistor, connected in parallel with a fixed resistor in the voltage divider string, varies with temperature, thus varying the input voltage to the comparator. As a result, output voltage decreases as printhead temperature increases, thus maintaining uniform print character darkness, or density.

3-73. Power Supply Protection

3-74. Three circuits in the power supply provide circuit protection. Two low voltage protection circuits are present; one resets the microcomputer if the supply

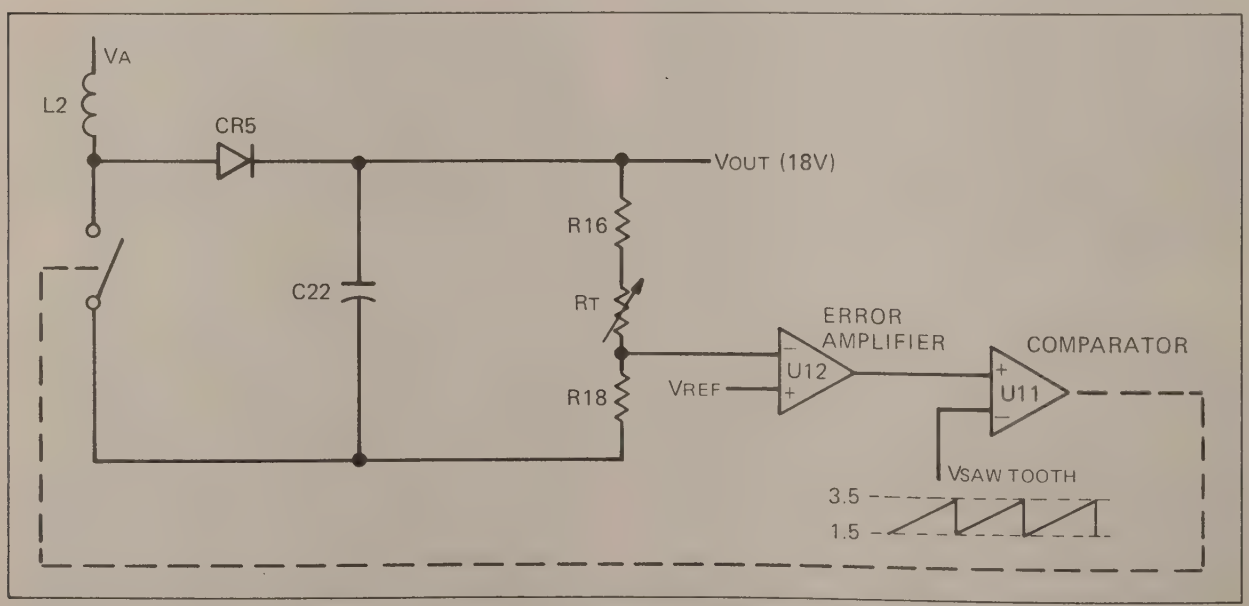


Figure 3-17. Positive 18 Volt Power Supply Simplified Schematic

voltage (VA) goes below 8.57V dc, and the other resets the microcomputer if the positive 5V dc output falls below positive 4V dc. A current limit circuit protects the positive 5V dc power supply section.

3-75. Low voltage protection is provided by two comparator circuits, each circuit utilizing one-half of a dual comparator IC (U13). Comparator U13A compares a scaled portion of the input voltage (VA) to a 2.5V reference voltage. If input voltage drops below 8.57V dc, the comparator positive input drops below the reference voltage, and comparator output goes to a low logic level, initiating a reset to the microcomputer. The microcomputer then turns off the 18 volt supply to the motor and printhead. Comparator circuit U13B monitors the positive 5 volt supply in the same fashion, and issues a microcomputer reset in the same manner, with the same result.

3-76. Positive 5 volt power supply current is limited to approximately 1 ampere. A transistor (Q9) and three parallel resistors (R5, R6, R7) perform the current limiting function. A current of 1 ampere through the parallel resistors results in a .5V dc voltage drop. This voltage drop turns on the transistor, which sources current to the shutdown circuitry within the pulse width modulator (U9). Pulse width modulator duty cycle decreases, thereby lowering the output voltage but maintaining a constant current. If the positive 5 volt output falls below 4 volts, the low voltage limit circuit resets the microcomputer.

3-77. PROGRAM FUNCTIONS

3-78. Programming resident in the microcomputer controls all major printer functions; i.e., the input sequence, print cycle, and plot mode operation.

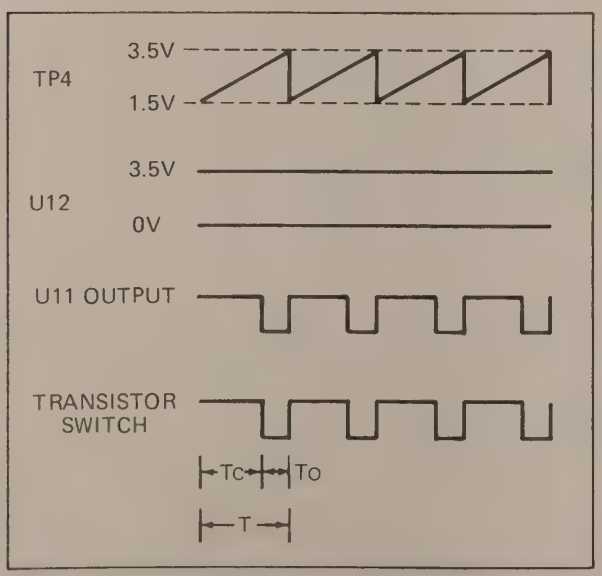


Figure 3-18. Power Supply Waveforms

3-79. Printer input is an ASCII string which consists of 20 ASCII characters. Each character is read-in using a handshake mode under firmware control. The input character string is terminated by an ASCII Line Feed input, and any character beyond the twentieth character, except a Line Feed, is deleted. An ASCII Form Feed control character advances the printer paper to the next print line. Refer to Table 3-3. Valid ASCII characters for the printer are the standard 64-character ASCII set, plus special characters shown in the table.

3-80. Programming controls the printhead and motor electronics to print the character represented by the input ASCII code. It also initiates a print cycle when the

Table 3-3. 2030A Valid Characters

CODE	CHAR	CODE	CHAR
32		69	E
33	!	70	F
34	"	71	G
35	#	72	H
36	$	73	I
37	%	74	J
38	&	75	K
39	'	76	L
40	(	77	M
41	)	78	N
42	*	79	O
43	+	80	P
44	,	81	Q
45	-	82	R
46	.	83	S
47	/	84	T
48	0	85	U
49	1	86	V
50	2	87	W
51	3	88	X
52	4	89	Y
53	5	90	Z
54	6	91	[
55	7	92	\
56	8	93	]
57	9	94	^
58	:	95	_
59	;	100	`
60	<	102	f
61	=	107	k
62	>	109	m
63	?	110	n
64	@	112	p
65	A	114	r
66	B	115	s
67	C	117	u
68	D	122	z

SINGLE PRINT or CONTINUOUS PRINT switch is pushed, and it advances the paper when the PAPER ADVANCE switch is pushed. Firmware controls binary dot positions in plot mode operation.

3-81. Firmware programming initiates and controls a print cycle upon receipt of a PRINT command. As shown in Figure 3-19, a print cycle consists of seven dot-strobe cycles followed by three paper advances. Figure 3-20 represents a typical dot-strobe cycle. During each dot-strobe cycle, each Dot Select Bus receives power in sequence. If a particular digit is enabled during the time a Dot Select Bus receives power, that print dot in that digit will print. When all Dot Select Bus lines have been strobed, the paper is advanced one step and the dot-strobe cycle is repeated. After seven dot-strobe cycles, an additional three paper advance pulses are produced to provide a space between print lines. The fourth paper advance shown in Figure 3-19 is the paper advance that follows every dot-strobe cycle.

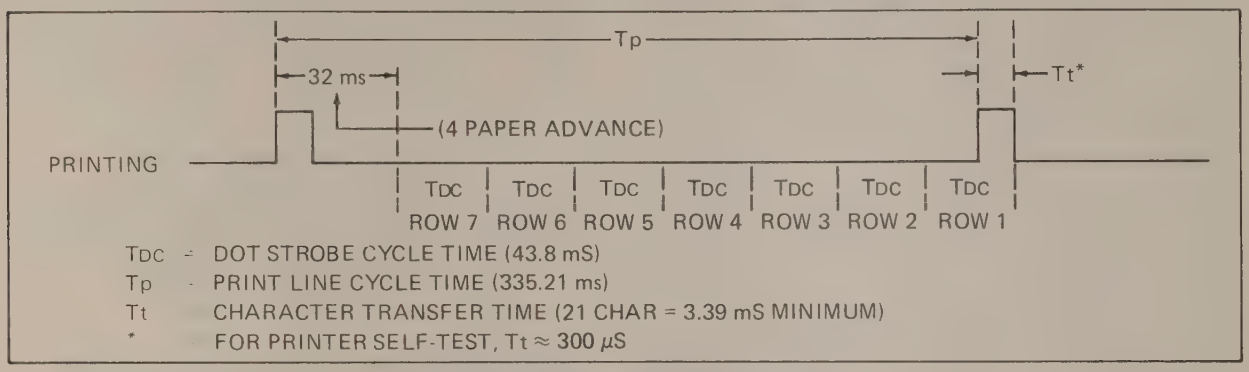

Tp
32 ms
Tt*
(4 PAPER ADVANCE)
PRINTING
TDC TDC TDC TDC TDC TDC TDC
ROW 7 ROW 6 ROW 5 ROW 4 ROW 3 ROW 2 ROW 1
TDC = DOT STROBE CYCLE TIME (43.8 mS)
Tp = PRINT LINE CYCLE TIME (335.21 ms)
Tt CHARACTER TRANSFER TIME (21 CHAR = 3.39 mS MINIMUM)
* FOR PRINTER SELF-TEST, Tt ≈ 300 μS

Figure 3-19. Printing Cycle Timing Diagram

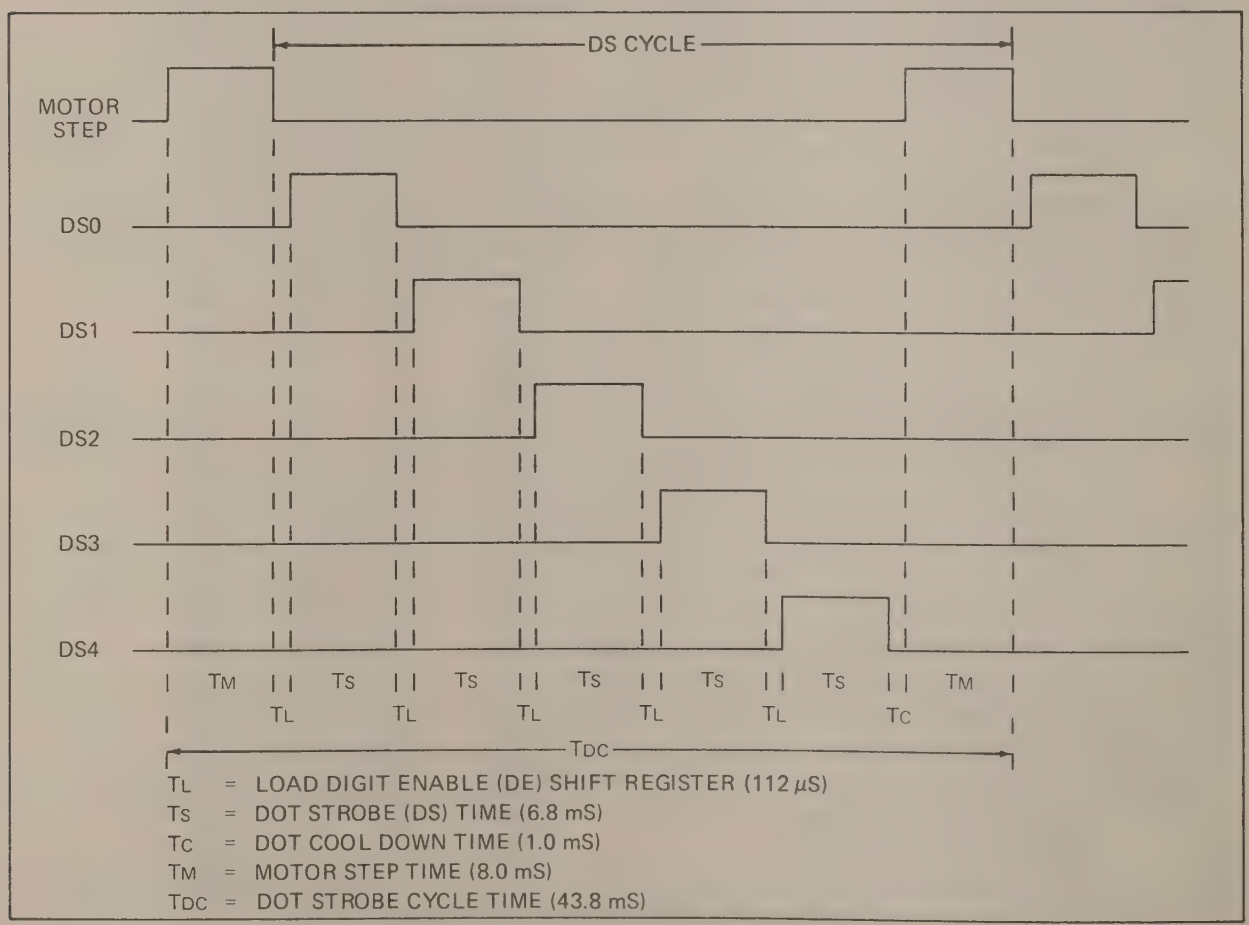

DS CYCLE
MOTOR STEP
DS0
DS1
DS2
DS3
DS4
TM TS TS TS TS TS TM
TL TL TL TL TL TC
TDC
TL = LOAD DIGIT ENABLE (DE) SHIFT REGISTER (112 μS)
TS = DOT STROBE (DS) TIME (6.8 mS)
TC = DOT COOL DOWN TIME (1.0 mS)
TM = MOTOR STEP TIME (8.0 mS)
TDC = DOT STROBE CYCLE TIME (43.8 mS)

Figure 3-20. Dot Strobe Cycle Timing Diagram

Section 4
Maintenance

WARNING

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

4-1. INTRODUCTION

4-2. This section of the manual provides information about warranty, factory service, maintenance, performance testing, routine calibration adjustments and repair. The performance test is recommended as an acceptance test when the unit is first received, and later as a calibration procedure to verify the instrument specifications given in Section 1. A printer self-test feature is standard; it should be performed each time the printer is turned on. No test equipment is required.

4-3. SERVICE INFORMATION

4-4. The Model 2030A Programmable Printer is warranted for a period of 1 year upon delivery to the original purchaser. The WARRANTY is located on the back of the title page located in the front of this manual.

4-5. Factory authorized calibration and service for each Fluke product is available at various worldwide locations. A complete list of these service centers is included in Section 7 of this manual. If requested, an estimate will be provided to the customer before any work is begun on instruments that are beyond the warranty period.

4-6. GENERAL MAINTENANCE

4-7. Instrument Disassembly

4-8. The printer must be removed from the case to perform certain maintenance procedures. To disassemble the Model 2030A Programmable Printer and remove it from the case use the following procedure:

1. Disconnect all power cords and input cables.

2. Remove the four screws in the bottom of the case that secure the cover.

3. Lift the cover clear of the unit by pulling straight up.

4. Disconnect the two ribbon cables from the Printer PCB and the keyboard to the PTI System Interface.

5. Remove the single screw securing the front of the PTI System Interface and the two hex-head screws securing the input connector to the rear panel.

6. Remove the PTI System Interface.

7. Remove the two Printer PCB retaining screws, one located near the center of the Printer PCB and one centered near the front of the pcb.

8. Lift the latch under the front of the printer chassis, and pull the printer chassis out to the stop point.

9. Remove the two hex-nuts at the left side of the

printer chassis (viewed from the front) which secure the printer chassis stop to the Printer PCB.

10. Pull the printer chassis forward, clear of the Printer PCB, then disconnect the printer chassis ribbon cable.

11. Lift the front panel and the front of the Printer PCB, and slide the front panel forward off of the switches mounted on the Printer PCB.

12. Release the plastic clips that hold the keyboard to the front panel and remove it.

13. Lift the Printer PCB and the rear panel clear of the case bottom simultaneously.

14. To reassemble the 2030A Programmable Printer, logically reverse the preceding steps.

4-9. Fuse Replacement

WARNING

DISCONNECT ALL POWER INPUTS BEFORE REPLACING FUSES.

4-10. The ac and dc inputs are individually fuse protected. Both fuses are readily accessible from the outside of the rear panel. To replace a fuse, insert a screwdriver in the grey fuse cap, push the cap in slightly and turn it ¼ turn counterclockwise. Remove the fuse cap, replace the fuse, and reinstall the fuse cap. The ac line input fuse (F1) requires a ½ amp slo-blo fuse if the 90 to 132 volt input range is in use; use a ¼ amp slo-blo replacement fuse if the 180 to 250 volt input range is in use. The external dc input fuse (F2) requires a 5 amp slo-blo replacement fuse.

4-11. Line Voltage Selection

4-12. Two ac line input voltage ranges are switch selectable in the 2030A Printer: 90-132 volts and 180-250 volts. The line voltage select switch (S5) position determines the acceptable ac line voltage. To check or change the line voltage select switch position, remove the top cover from the 2030A case. (Refer to Instrument Disassembly.) Switch S5 is located at the right rear corner of the Printer PCB, as viewed from the front. The slide switch must be forward, toward the front panel, with the white dot exposed, for 90 to 132 volt operation. The red dot must be exposed for 180 to 250 volt operation. Refer to Figure 4-1.

4-13. Cleaning

4-14. Clean the instrument periodically to remove dust, grease, and other contamination. Use the following procedure:

CAUTION

Do not use aromatic hydrocarbons or chlorinated solvents for cleaning. They may damage plastic materials used in the instrument.

1. Clean the front panel and case with a soft cloth dampened with a mild solution of detergent and water.

2. Clean pcb surfaces using clean, dry air at low pressure (≤20 psi).

3. If grease is encountered, spray with anhydrous alcohol and remove grime with clean, dry air at low pressure.

4-15. PERFORMANCE TEST

4-16. A partial performance test of the Model 2030A Programmable Printer may be performed by initiating the printer self-test function. To initiate the programmed self-test, push the PAPER ADVANCE switch within 1 second of pushing POWER ON. If all circuitry on the Printer PCB is functioning properly, and if the printhead is good, the 2030A will produce a slash mark (/) in each of the twenty columns. The printer will continue to produce slash marks until the PAPER ADVANCE switch is released.

4-17. Further 2030A performance testing requires a known good input from a digital instrument. Connect the printer and input instrument as described in Section 2. If the printer output matches the displayed input instrument value, and if all printer functions are programmable, the PTI System Interface and keyboard are functioning properly.

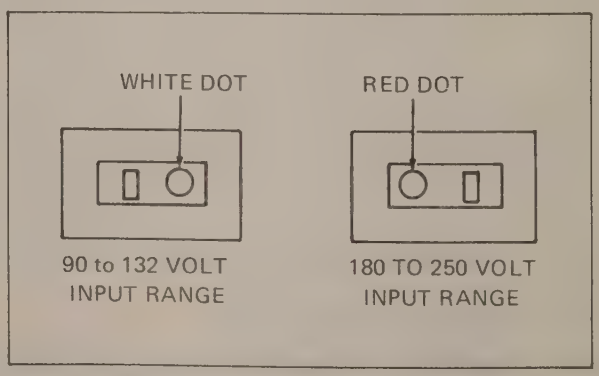


Figure 4-1. AC Line Voltage Selection

4-18. CALIBRATION ADJUSTMENT

4-19. Model 2030A Programmable Printer circuitry does not require periodic or post-repair calibration adjustment.

4-20. TROUBLESHOOTING

4-21. Troubleshooting information presented in Tables 4-1 through 4-6, is intended as a guide to assist in isolating a malfunction to the component level. Table 4-1 provides a guide to determining which functional circuit section is defective; each of the remaining five tables provide a guide to isolating the defective component within that specific functional circuit section. The tables are arranged in a tabular flow chart format. When a step on the tabular flow chart is complete, check for a decision transfer. If no decision transfer is required, perform the next step on the table in sequence.

Table 4-1. Troubleshooting Guide

STEP NO.	ACTION	Go to the step number given for correct response	
		YES	NO
1	Are both power supply outputs present and correct?	2	6
2	Did all digits print during the performance test?	3	7
3	Did all dots in all digits print?	4	8
4	Did the paper advance motor function correctly?	5	9
5	Do all operator programmable functions operate correctly?	11	10
6	Consult Table 4-2.		
7	Consult Table 4-3.		
8	Consult Table 4-4.		
9	Consult Table 4-5.		
10	Consult Table 4-6.		
11	All circuit sections are functioning correctly.		

Table 4-2. Power Supply Troubleshooting Guide

STEP NO.	ACTION	Go to the step number given for correct response	
		YES	NO
1	Is positive 5V dc present at TP2?	2	9 (3)
2	Is positive 18V dc present at TP3?	11	10 (3)
3	Are both output voltages absent?	4	9, 10
4	Check fuses F1 and F2.		
5	Check switch S5 for proper position.		
6	Is voltage VA present? (+ side of C8).	8	7
7	Check the input transformer, bridge rectifier, and regulating diode.		
8	Check the Pulse Width Modulator and Reference Voltage Regulator. (TP4 — see Figure 3-18.)		
9	Check +5V power supply circuit. Refer to Section 3, and to Figures 3-15 and 3-16.		
10	Check +18V power supply circuit. Refer to Section 3, and to Figures 3-17 and 3-18.		
11	Power Supply troubleshooting is complete. Disconnect all test equipment.		

Table 4-3. Digit Enable Troubleshooting Guide

STEP NO.	ACTION	Go to the step number given for correct response	
		YES	NO
1	Remove the printer case. (See Instrument Disassembly.)		
2	Is the Digit Enable command present at the applicable output of U2, U5, or U7? (Refer to schematic, Section 8.)	3	4
3	Repair or replace the printhead.		
4	Is the Digit Enable command present at the output of either the Shift Registers or Inverters?	5	6
5	Check the appropriate Darlington array (U2, U5, or U7).		
6	Are Digit Enable commands present at microcomputer output pins 21, 22, 23, and 24?	7	9
7	Is a strobe signal present at microcomputer output pin 25?	8	9
8	Check the appropriate Shift Register or the Inverter.		
9	Is microcomputer input line 1 (Port 1) low and line 28 low with a ≈300 μs pulse, spaced at ≈331 ms?	10	11
10	Check the microcomputer.		
11	Consult the PTI System Interface troubleshooting procedure, Table 4-6.		

Table 4-4. Dot Enable Troubleshooting Guide

STEP NO.	ACTION	Go to the step number given for correct response	
		YES	NO
1	Did the same dot or dots in all digits fail to print?	3	2
2	Check the printhead.		
3	Did all dots fail to print?	12	4
4	Is +16 to +18 volts present at the output of the applicable transistor (Q2, Q3, Q4, Q5, or Q6)?	5	6
5	Check the connectors and cable between the Printer PCB and print unit. Also check the printhead.		
6	Are Dot Select commands present at the output of the appropriate Buffer Driver?	7	8
7	Check the appropriate Darlington transistor (Q2, Q3, Q4, Q5, or Q6).		
8	Are Dot Select commands present at the applicable output of the microcomputer?	9	10
9	Check the appropriate Buffer Driver.		
10	Are microcomputer input lines 1 (Port 1) and 28 low, with a positive ≈300 μs pulse, spaced ≈331 ms on line 28?	11	15
11	Check the microcomputer.		
12	Is positive 16 to 18 volts present at the output of Darlington transistor Q1?	14	13
13	Refer to Table 4-4, Motor Circuit Troubleshooting Guide.		
14	Check circuit path between Q1 output and Q2-Q6 inputs.		
15	Consult the PTI System Interface troubleshooting procedure in Table 4-6.		

Table 4-5. Motor Circuit Troubleshooting Guide

STEP NO.	ACTION	Go to the step number given for correct response	
		YES	NO
1	Did the Paper Advance Motor fail completely?	2	12
2	Is +16 to +18V dc present at the output of transistor Q1?	3	4
3	Check the motor and all lines and connections from the Printer PCB to the motor.		
4	Is +16 to +18V dc present at the input to transistor Q1?	6	5
5	Refer to Table 4-2, Power Supply Troubleshooting Guide.		
6	Is a motor power command present at the base of Q1?	7	8
7	Check transistor Q1.		
8	Is a motor power command present at the Buffer Driver input?	9	10
9	Check the Buffer Driver.		
10	Is the microcomputer supplying motor power commands?	12	11
11	Troubleshoot the microcomputer and associated components.		
12	Are motor enable commands present at pins 15, 16, 17, and 18 of Transistor array U2?	13	14
13	Are the motor enable commands constantly changing logic states?	3	14
14	Are constantly changing motor commands being supplied on microcomputer pins 35, 36, 37, and 38?	15	11
15	Motor Circuit Troubleshooting is complete.		

Table 4-6. PTI System Interface Troubleshooting Guide

STEP NO.	ACTION	Go to the step number given for correct response	
		YES	NO
1	Is data transferred through the PTI System Interface?	2	4
2	Do the operator programmable functions operate correctly?	3	12
3	Do the BCD switches program addresses 7, 8, and 9.		
4	Is the correct BCD address code present at the address latch output?	6	5
5	Check the address latch.		
6	Are handshake and print signals present at the microcomputer?	8	7
7	Check the appropriate handshake or print signal buffers.		
8	Is data present at the data buffer output?	10	9
9	Check the data buffers.		
10	Is ASCII data present at microcomputer port 1.	14	11
11	Check the microcomputer and PROM.		
12	Check the keyboard encoder, latch, and bus enable decoder.		
13	Check the appropriate BCD switch and buffer.		
14	PTI System Interface troubleshooting is complete.		

Section 5
List of Replaceable Parts

TABLE OF CONTENTS

ASSEMBLY NAME	DRAWING NO.	TABLE NO.	TABLE PAGE	FIGURE NO.	FIGURE PAGE
Final Assembly, Model 2030A	2030A-T&B/4201	5-1	5-3	5-1	5-4
A1 Printer Main PCB Assembly	2030A-1601	5-2	5-6	5-2	5-9
A2 Printer Mechanism Assembly	2030A-4202	5-3	5-10	5-3	5-11
A2A1 Interconnect PCB Assembly	2030A-1604	5-4	5-12	5-4	5-12
A3 Keyboard PCB Assembly	2030A-1602	5-5	5-13	5-5	5-13
A4 PTI System Interface PCB Assembly	2030A-1603	5-6	5-14	5-6	5-15

5-1. INTRODUCTION

5-2. This section contains an illustrated parts breakdown of the 2030A Programmable Printer. Components are listed alphanumerically by assembly. Both electrical and mechanical components are listed by reference designation. Each listed part is shown in an accompanying illustration.

5-3. Parts lists include the following information:

1. Reference Designation.

2. Description of each part.

3. FLUKE Stock Number.

4. Federal Supply Code for Manufacturers. (See Section 7 for Code-to-Name list.)

5. Manufacturer's Part Number.

6. Total Quantity of components per assembly.

7. Recommended Quantity: This entry indicates the recommended number of spare parts necessary to support one to five instruments for a period of 2 years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for 1 year or more at an isolated site, it is recommended that at least one of each assembly in the instrument be stocked (see paragraph 5-7). In the case of optional subassemblies, plug-ins, etc., that are not always part of the instrument, or are deviations from the basic instrument model, the REC QTY column lists the recommended spares quantity for the items in that particular assembly.

5-4. HOW TO OBTAIN PARTS

5-5. Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. or its authorized representatives by using the FLUKE STOCK NUMBER. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions if necessary.

5-6. To ensure prompt and efficient handling of your order, include the following information.

1. Quantity.

2. FLUKE Stock Number.

3. Description.

4. Reference Designation.

5. Printed Circuit Board Part Number and Revision Letter.

6. Instrument Model and Serial Number.

5-7. A Recommended Spare Parts Kit for your basic instrument is available from the factory. This kit contains those items listed in the REC QTY column of the Parts List in the quantities recommended.

5-8. Parts price information is available from the John Fluke Mfg. Co., Inc. or its representatives. Prices are also available in a Fluke Replacements Parts Catalog which is available on request.

CAUTION

Indicated devices are subject to damage by static discharge.

Table 5-1. Final Assembly, Model 2030A

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
A	FINAL ASSEMBLY, MODEL 2030A FIGURE 5-1 (2030A-T&B/4201)						
A1	Ⓧ PRINTER PCB ASSEMBLY	490144	89536	490144	1		
A2	PRINTER MECHANISM ASSEMBLY	490060	89536	490060	1		
A3	KEYBOARD ASSEMBLY	490243	89536	490243	1		
A4	Ⓧ PTI SYSTEM INTERFACE	490151	89536	490151	1		
F1	FUSE	ORDER	FOR	APPROPRIATE VOLTAGE	1	5	
	FUSE, SLO-BLO, 1/2 AMP (90/132V)	109322	71400	MDL1-2			
	FUSE, SLO-BLO, 1/4 AMP (180/250V)	166306	71400	MDL1-4			
F2	FUSE, SLO-BLO, 5 AMP	109215	71400	MDA5A	1	5	
H1	LOCKWASHER, SPLIT	110692	73734	1358	1		
H2	NUT, HEX, 6-32	110551	73734	8006NP	1		
H3	NUT, HEX, S/STEEL, #6	110569	73734	70206	1		
H4	SCREW, CONNECTOR	520106	00779	552657-1	2		
H5	SCREW, FHP, COUNTERSUNK, 6-32 X 5/8	114876	89536	114876	4		
H6	SCREW, PHP, 6-32 X 1/4"	385401	89536	385401	1		
H7	SCREW, THD FORMING	501114	89536	501114	2		
MP1	BAIL	467555	89536	467555	1		
MP2	COVER ASSEMBLY "D" SIZE	516682	89536	516682	1		
MP3	DECAL, BASE SIDES	473652	89536	473652	1		
MP4	DECAL, BOTTOM	483370	89536	483370	1		
MP5	DECAL, FRONT PANEL	483362	89536	483362	1		
MP6	DECAL, NAMEPLATE	504456	89536	504456	1		
MP7	FOOT, NONSKID	467571	89536	467571	4		
MP8	LATCH	467548	89536	467548	2		
MP9	LUG, GROUNDING	132399	78189	2104-06-00	1		
MP10	PANEL, FRONT	490250	89536	490250	1		
MP11	REAR PANEL	490201	89536	490201	1		
MP12	PAPER HOLDER	490318	89536	490318	1		
MP13	PRINTER FRONT	490276	89536	490276	1		
MP14	PRINTER STOP	521138	89536	521138	1		
MP15	PTI BASE MODIFIED	515734	89536	515734	1		
MP16	SPACER, HEX, 6-32 X 3"	103895	89536	103895	1		
MP17	THERMAL PAPER	514257	89536	514257	AR		
W1	CABLE ASSEMBLY	475228	89536	475228	1		
W2	CABLE, FLEX	512611	89536	512611	1		
W3	LINE CORD (NOT SHOWN)	343723	89536	343723	1		
XF1	FUSEHOLDER BODY	375188	89536	375188	2		
	FUSEHOLDER CAP	460238	89536	460238	2		
XF2	FUSEHOLDER BODY	375188	89536	375188	REF		
	FUSEHOLDER CAP	460238	89536	460238	REF		
	INSTRUCTION MANUAL (2030A) (NOT SHOWN)	504027	89536	504027	1		
	RECOMMENDED SPARE PARTS KIT	526095	89536	526095			

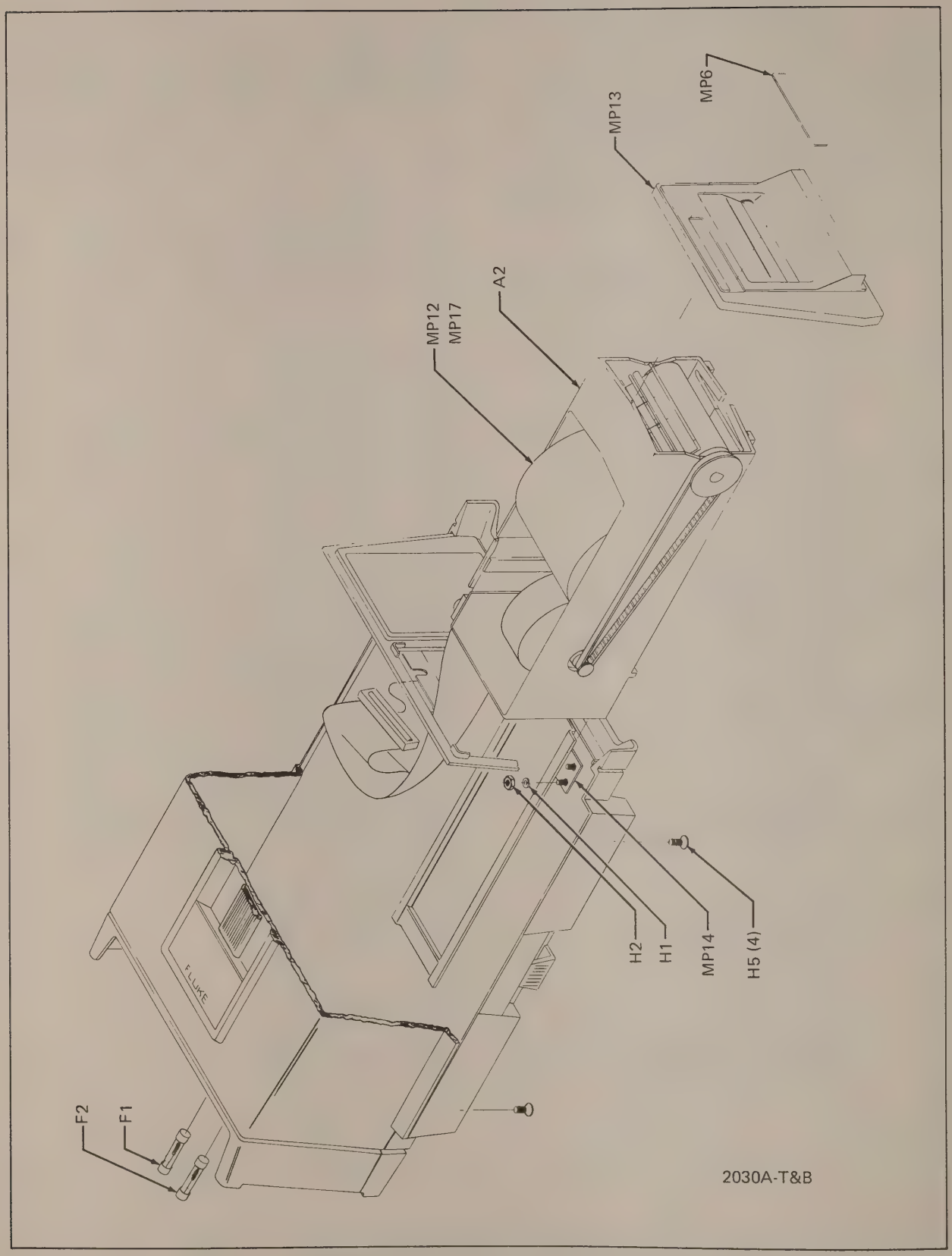


Figure 5-1. Final Assembly, Model 2030A

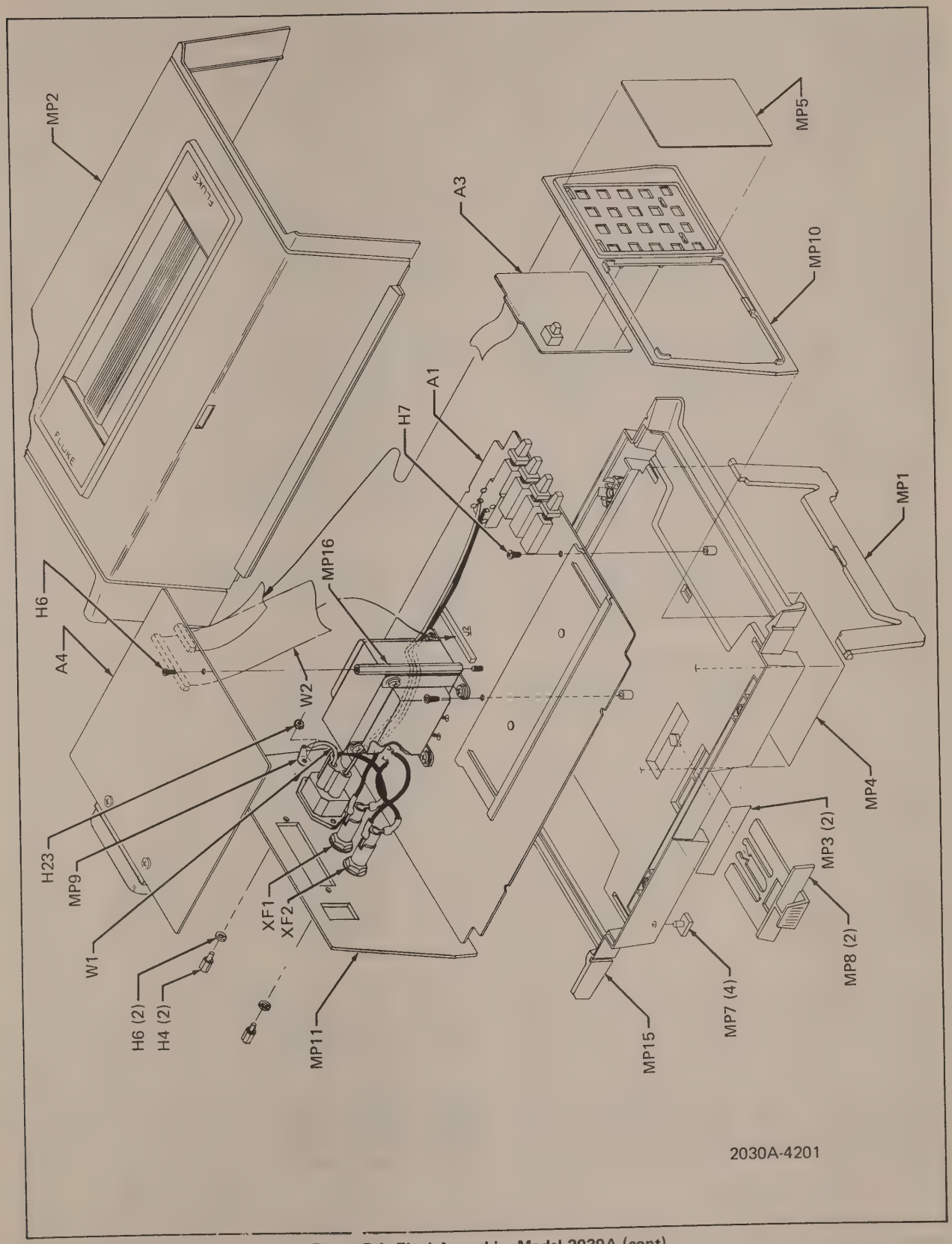


Figure 5-1. Final Assembly, Model 2030A (cont)

Table 5-2. A1 Printer, Main PCB Assembly

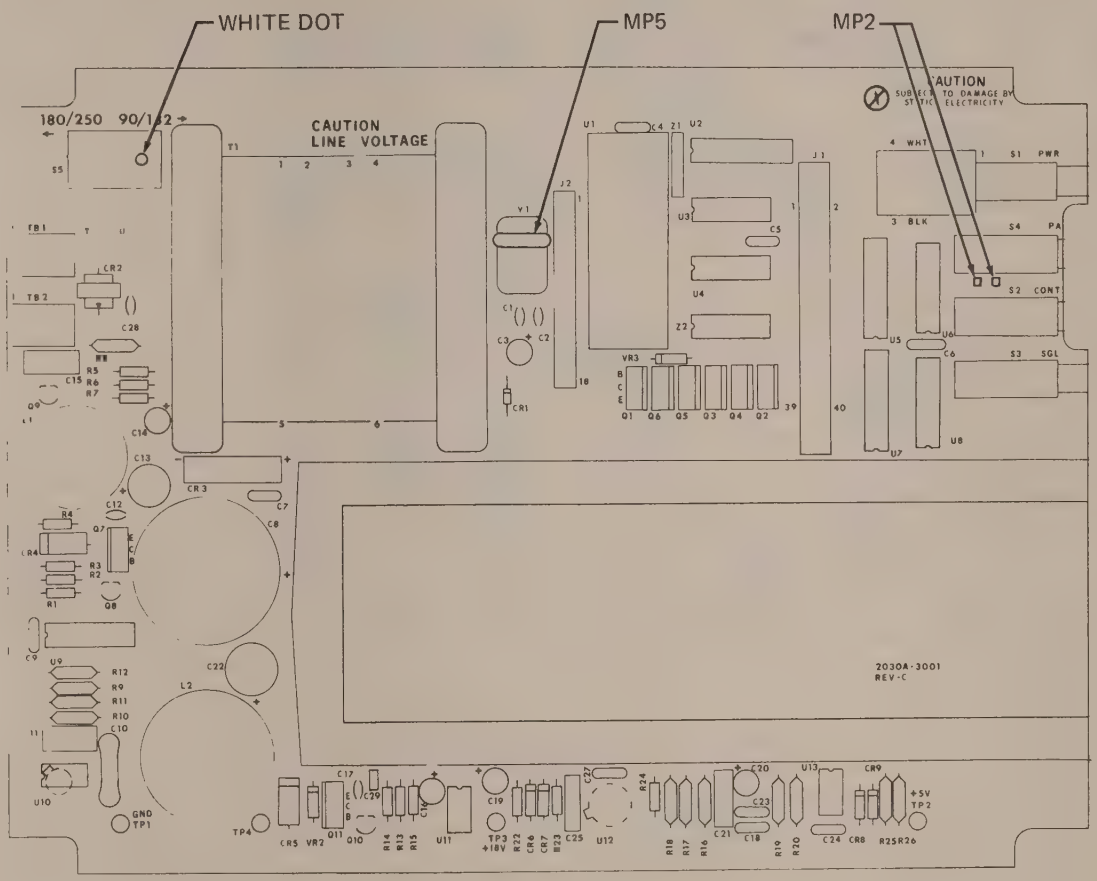
REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
A1	Ⓐ PRINTER, MAIN PCB ASSEMBLY FIGURE 5-2 (2030A-4001T)	490144	89536	490144	REF		
C1	CAP, CER, 20 PF +/-10%, 500V	106369	72982	831-000-T2H0-200K	2		
C2	CAP, CER, 20 PF +/-10%, 500V	106369	72982	831-000-T2H0-200K	REF		
C3	CAP, TA, 6.8 UF +/-20%, 35V	363713	56289	196D685X0035KA1	4		
C4	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	9		
C5	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
C6	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
C7	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
C8	CAP, ELECT, 4500 UF -10/+75%, 25V	493684	06001	86F537	1		
C9	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
C10	CAP, MICA, 3300 PF +/-2%, 500V	192518	72136	DM19F332G	1		
C11	CAP, MYLAR, 0.033 UF +/-10%, 50V	271841	80031	75F1R5A333	1		
C12	CAP, CER, 5000 PF +/-20%, 100V	175232	56289	C023B101E502M	1		
C13	CAP, ELECT, 220 UF -10/+100%, 6.3V	494567	56289	672D227H6R3CG2C	1		
C14	CAP, TA, 22 UF +/-20%, 15V	423012	56289	196D226X0015KA1	1		
C15	CAP, POLYFILM, 0.47 UF +/-10%, 250V	162008	73445	C280MAE/A47K	1		
C16	CAP, TA, 6.8 UF +/-20%, 35V	363713	56289	196D685X0035KA1	REF		
C17	CAP, CER, 5000 PF +/-20%, 100V	175232	56289	C023B101E502M	REF		
C18	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
C19	CAP, TA, 6.8 UF +/-20%, 35V	363713	56289	196D685X0035KA1	REF		
C20	CAP, TA, 6.8 UF +/-20%, 35V	363713	56289	196D685X0035KA1	REF		
C21	CAP, POLYESTER, 0.082 UF +/-10%, 250V	342519	89536	342519	1		
C22	CAP, ELECT, 470 UF -10/+100%, 25V	494575	56289	672D4[illegible] H025DS2C	1		
C23	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
C24	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
[illegible]	CAP, POLYESTER, 0.010 UF +/-10%, 400V	402818	73445	C280MAH/A10K	1		
[illegible]	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
C28	CAP, CER, 0.025 UF [illegible] 100V	168435	56289	C023B101H253M	1		
C29	CAP, CER, .001 UF +/-20%, 500V	402966	32897	8121-A100-W5R-102M	1		
CR1	DIODE, GE	149187	22767	1N270	5	1	
CR2	RECTIFIER, SI	325746	04713	MR751	1	1	
CR3	RECTIFIER BRIDGE	428839	04713	MPA970-1	1	1	
CR4	RECTIFIER, SI, FAST RECOVERY	483701	14099	5FF10	2	1	
CR5	RECTIFIER, SI, FAST RECOVERY	483701	14099	5FF10	REF		
CR6	DIODE, GE	149187	22767	1N270	REF		
CR7	DIODE, GE	149187	22767	1N270	REF		
CR8	DIODE, GE	149187	22767	1N270	REF		
CR9	DIODE, GE	149187	22767	1N270	REF		
J1	CONNECTOR, PLUG	494823	22526	65692-025	1		
J2	SOCKET, CONNECTOR, 18-POS	435024	00779	583773-8	1		
L1	CHOKE	490870	89536	490870	1		
L2	CHOKE	490888	89536	490888	1		
MP1	SPACER, PCB STANOFF	285353	71590	J64284	3		
MP2	SOCKET, COMP.LEAD, PC MOUNT	376418	22526	75060-007	2		
MP3	BUTTON, SW, GRAY (NOT SHOWN)	425900	89536	425900	3		
MP4	BUTTON, SW, GREEN (NOT SHOWN)	445197	89536	445197	1		
MP5	HOLDER, RUBBER COMPONENT	422857	98159	2829-75-1	1		
Q1	XSTR, PWR, PNP	483693	09214	D45E2	6	2	

Table 5-2. A1 Printer, Main PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
Q2	XSTR, PWR, PNP	483693	09214	D45E2	REF		
Q3	XSTR, PWR, PNP	483693	09214	D45E2	REF		
Q4	XSTR, PWR, PNP	483693	09214	D45E2	REF		
Q5	XSTR, PWR, PNP	483693	09214	D45E2	REF		
Q6	XSTR, PWR, PNP	483693	09214	D45E2	REF		
Q7	XSTR, SI, PWR NPN	325761	09214	D44C5	1	1	
Q8	XSTR, SI, PNP	195974	04713	2N3906	2	1	
Q9	XSTR, SI, PNP	195974	04713	2N3906	REF		
Q10	XSTR, SI, NPN	330803	04713	MPS6560	1	1	
Q11	XSTR, SI, PWR, NPN	495010	09214	D44H11	1	1	
R1	RES, DEP. CAR, 160 +/-5%, 1/4W	441410	80031	CR251-4-5P160E	1		
R2	RES, DEP. CAR, 910 +/-5%, 1/4W	442335	80031	CR251-4-5P910E	1		
R3	RES, DEP. CAR, 68 +/-5%, 1/4W	414532	80031	CR251-4-5P68E	1		
R4	RES, DEP. CAR, 51 +/-5%, 1/4W	414540	80031	CR251-4-5P51E	2		
R5	RES, DEP. CAR, 1.5 +/-5%, 1/4W	442020	80031	CR251-4-5P1E5	3		
R6	RES, DEP. CAR, 1.5 +/-5%, 1/4W	442020	80031	CR251-4-5P1E5	REF		
R7	RES, DEP. CAR, 1.5 +/-5%, 1/4W	442020	80031	CR251-4-5P1E5	REF		
R8	RES, MTL. FILM, 3.01K +/-1%, 1/8W	312645	91637	CMF553011F	2		
R9	RES, MTL. FILM, 7.15K +/-1%, 1/8W	260356	91637	CMF557151F	1		
R10	RES, MTL. FILM, 100K +/-1%, 1/8W	248807	91637	CMF551003F	1		
R11	RES, MTL. FILM, 4.02K +/-1%, 1/8W	235325	91637	CMF554021F			
R12	RES, MTL. FILM, 3.01K +/-1%, 1/8W	312645	91637	CMF553011F	REF		
R13	RES, DEP. CAR, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K			
R14	RES, DEP. CAR, 51 +/-5%, 1/4W	414540	80031	CR251-4-5P51E	REF		
R15	RES, DEP. CAR, 27 +/-5%, 1/4W	348763	80031	CR251-4-5P27E	1		
R16	RES, MTL. FILM, 3.24K +/-1%, 1/8W	223578	91637	CMF553241F	1		
R17	RES, MTL. FILM, 1.4K +/-1%, 1/8W	344333	91637	CMF551401F	1		
R18	RES, MTL. FILM, 715 +/-1% , 1/8W	313080	91637	CMF557150F	1		
R19	RES, MTL. FILM, 1.1K +/-1%, 1/8W	241497	91637	CMF551101F	2		
R20	RES, MTL. FILM, 2.67K +/-1%, 1/8W	289587	91637	CMF552671F	1		
R22	RES, DEP. CAR, 2.7K +/-5%, 1/4W	386490	80031	CR251-4-5P2K7	1		
R23	RES, DEP. CAR, 47K +/-5%, 1/4W	348896	80031	CR251-4-5P47K	1		
R24	RES, DEP. CAR, 5.6K +/-5%, 1/4W	442350	80031	CR251-4-5P5K6			
R25	RES, MTL. FILM, 1.1K +/-1%, 1/8W	241497	91637	CMF551101F	REF		
R26	RES, MTL. FILM, 665 +/-1%, 1/8W	320028	91637	CMF556650F	1		
S1	SWITCH ASSEMBLY	473355	89536	473355	1		
S2	SWITCH ASSEMBLY, PUSHBUTTON	483453	89536	483453	1		
S3	SWITCH ASSEMBLY, PUSHBUTTON	483453	89536	483453	REF		
S4	SWITCH ASSEMBLY, PUSHBUTTON	483453	89536	483453	REF		
S5	SWITCH, SLIDE	234278	82389	XW1649	1		
TB1	TERMINAL BLOCK	479006	89536	479006	2		
TB2	TERMINAL BLOCK	479006	89536	479006	REF		
U2	IC, HI-VOL, HI-CURRENT, XSTR ARRAY	483685	56289	ULN-2803A	3	1	
U3	Ⓐ IC, C-MOS, HEX, INVERTER	404681	04713	MC1406BCP	1	1	
U4	IC, TTL, HEX, BUFFER/DRIVER	328021	01295	SN7417N	1	1	
U5	IC, HI-VOL, HI-CURRENT, XSTR ARRAY	483685	56289	ULN-2803A	REF		
U6	Ⓐ IC, C-MOS, DUAL, 4-BIT STATIC SHFT REG	340125	04713	MC14015BCP	2	1	
U7	IC, HI-VOL, HI-CURRENT, XSTR ARRAY	483685	56289	ULN-2803A	REF		
U8	Ⓐ IC, C-MOS, DUAL, 4-BIT STATIC SHFT REG	340125	04713	MC14015BCP	REF		
U9	IC LINEAR, REGULATING PULSE WITH MODLTR	454678	01295	SG3524N	1	1	

Table 5-2. A1 Printer, Main PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
U10	IC, LINEAR, 2.5V BAND GAP REF	472845	04713	MC14030	1	1	
U11	IC, LINEAR, VOLTAGE COMPARATOR	352195	01895	SN72311P	1	1	
U12	IC, LINEAR, OP AMP	453357	02735	CA3140T	1	1	
U13	IC, LINEAR, LO-PWR, DUAL VOL COMPARATOR	478354	01295	LM393N	1	1	
VR2	DIODE, 6.8V	260695	07910	1N754A	2		
VR3	DIODE, 6 8V	260695	07910	1N754A	REF		
XU1	SOCKET, IC, 40-PIN (NOT SHOWN)	418988	09922	DILB40P-108	1		
Y1	CRYSTAL, 6 MHZ	461665	89536	461665	1		
Z1	RES, NETWORK, 4.7K	494690	89536	494690	1	1	
Z2	RES, NETWORK, 1K	407445	89536	407445	1	1	



2030A-1601

Figure 5-2. A1 Printer, Main PCB Assembly

Table 5-3. A2 Printer Mechanism Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
A2	PRINTER MECHANISM ASSEMBLY FIGURE 5-3 (2030A-4202)	490060	89536	490060	REF		
A2A1	INTERCONNECT ASSEMBLY	521047	89536	521047	1		
H1	SCREW, PHP, 4-40 X 1/4, SEMS	185918	89536	185918	2		
H2	SCREW, PHP, TH/FORM 8-18 X 5/16	513648	78189	HI-LO 8-18 X 5/16	2		
H3	SCREW, PHP, TH/FROM 4-9 X 1/4	519116	78189	HI-LO 4-9 X 1/4	2		
MP1	BELT, TOOTHED TIMING	500926	89536	500926	1		
MP2	MOTOR, STEPPING	500082	82227	A82770	1		
MP3	CONNECTOR, TERMINAL CABLE	494088	00779	530553-2	8		
MP4	PIVOT ROD	503318	89536	503318	2		
MP5	PRINTER CHASSIS, LEFT	490292	89536	490292	1		
MP6	PRINTER CHASSIS, RIGHT	490284	89536	490284	1		
MP7	PULLEY	490334	89536	490334	1		
MP8	PULLEY, TOOTHED TIMING	500934	89536	500934	1		
MP9	RUBBER ROLLER	495291	89536	495291	1		
MP10	SPRING, LEFT HAND	504811	89536	504811	1		
MP11	SPRING, RIGHT HAND	504803	89536	504803	1		
MP12	STRAIN RELIEF	521146	89536	521146	1		
MP13	PRINTHEAD ASSEMBLY	490078	89536	490078	1		
MP14	PRINTHEAD THERMAL	483677	89536	483677	1		
MP15	DECAL, INSTRUCTION CARD	508374	89536	508374	1		
MP16	HEATSINK	504571	89536	504571	1		
MP17	PAD	504654	89536	504654	1		
MP18	PRINTHEAD RETAINER	490300	89536	490300	1		
MP19	BEARING, SINTERED BRONZE * STOCK DRIVE PRODUCTS	513499	*	74B-F004	2		
P4	CONNECTOR, 8-POSITION CABLE	494120	00779	530554-7	1		

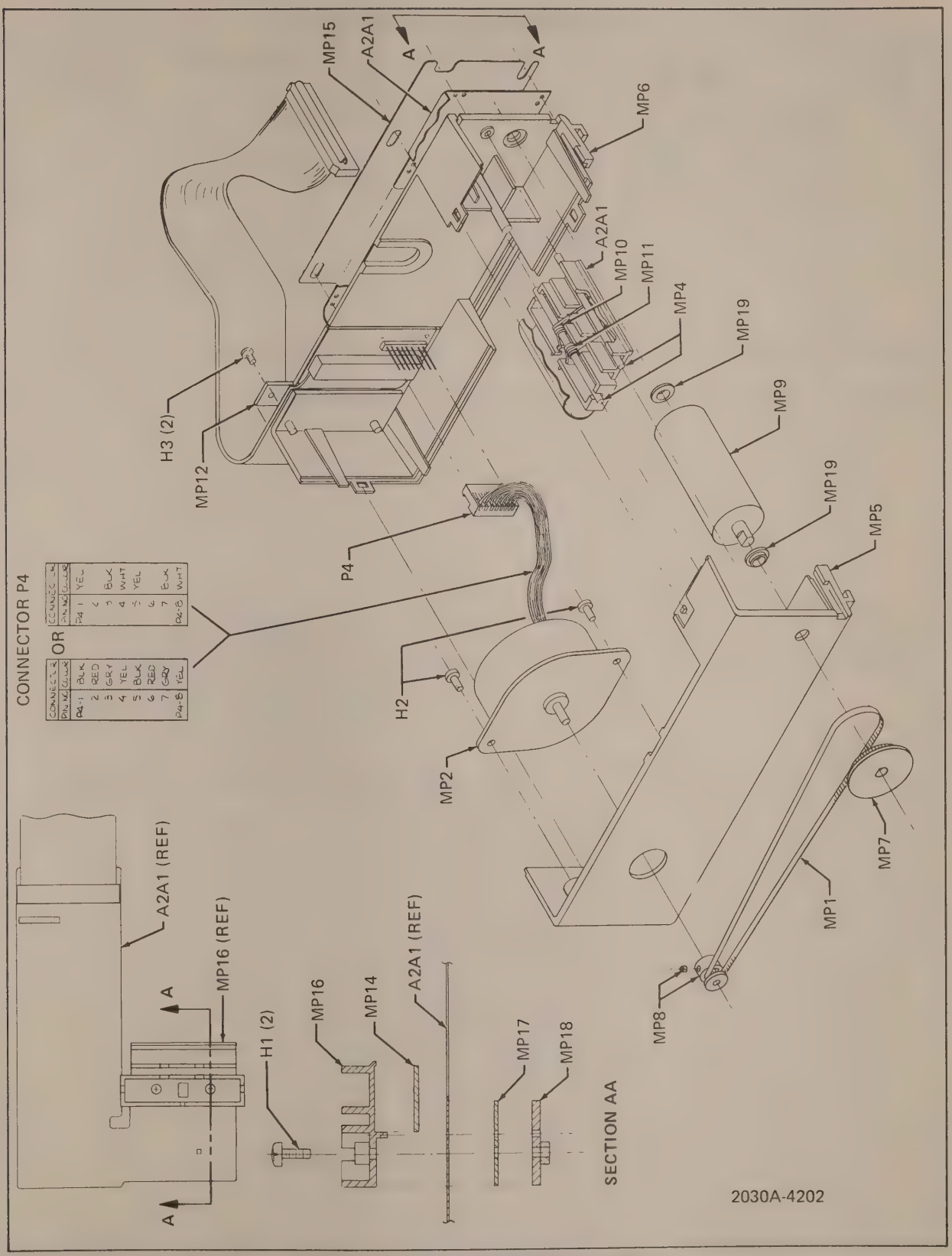


Figure 5-3. A2 Printer Mechanism Assembly

Table 5-4. A2A1 Interconnect PCB Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
A2A1	INTERCONNECT ASSEMBLY FIGURE 5-4 (2030A-4004)	521047	89536	521047	REF		
J4	POST CONTACT, 8-POSITION	520502	89536	520502	1		
J5	CABLE ASSEMBLY, PRINTER	483834	89536	483834	1		
MP1	PCB ASSEMBLY, INTERCONNECT	490193	89536	490193	1		
R1	RES THERMISTOR, 10K +/-10%, 3 MW	104596	15801	JA41J1	1		

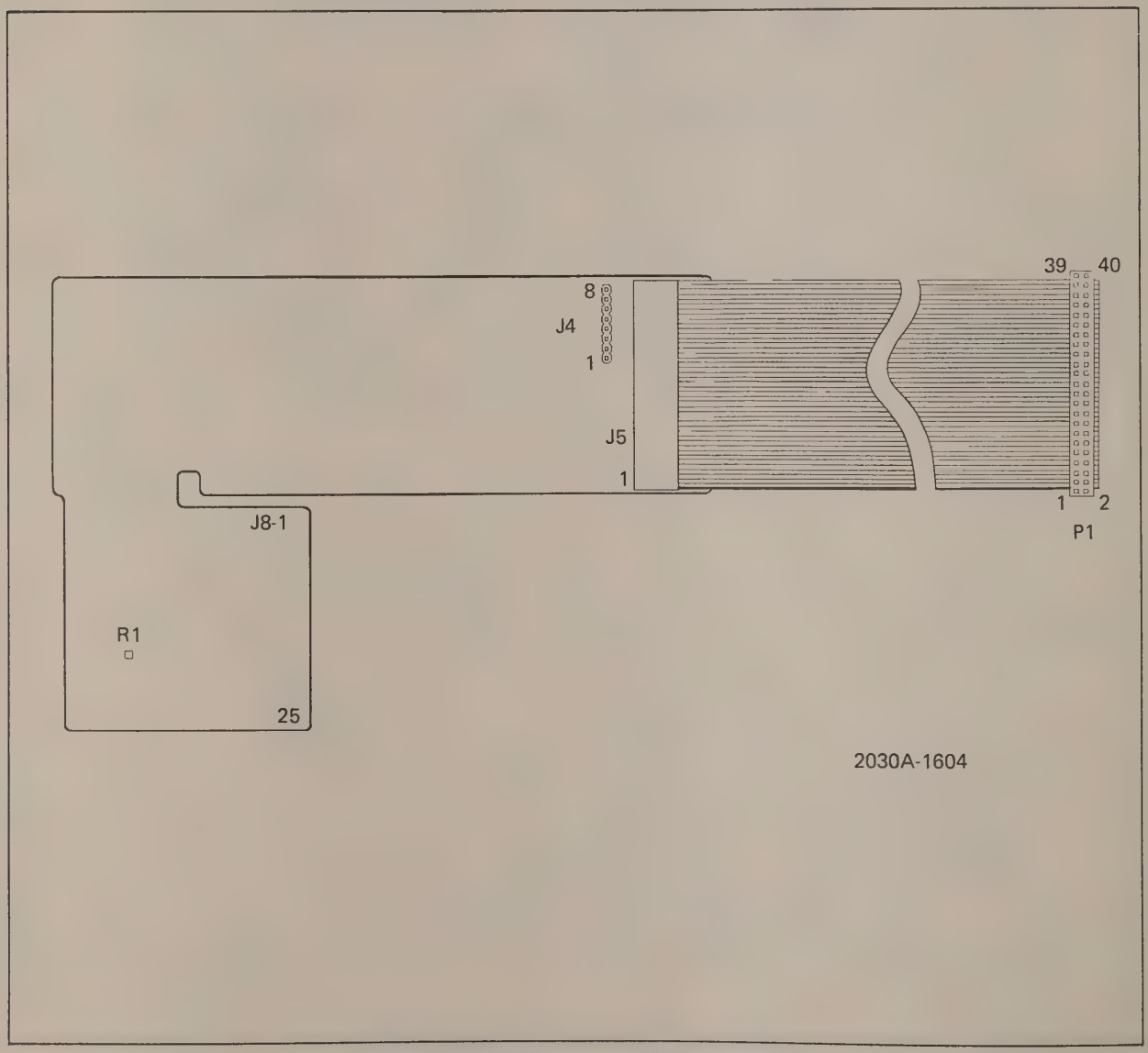


Figure 5-4. A2A1 Interconnect PCB Assembly

Table 5-5. A3 Keyboard PCB Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
A3	KEYBOARD ASSEMBLY FIGURE 5-5 (2030A-4002T)	490243	89536	490243	REF		
MP1	PUSHBUTTON (RED-ORG)	514422	89536	514422	1		
MP2	PUSH BUTTON (ORANGE)	420638	89536	420638	1		
MP3	PUSH BUTTON (GRAY)	401307	89536	401307	2		
MP4	PUSH BUTTON (GRAY)	401307	89536	401307	REF		
MP5-MP16	PUSH BUTTON (WHITE)	406774	89536	406774	12		
P3	CABLE, JUMPER, 8-CONDUCTOR	512608	00779	86947-7	8		
S1-S16	SWITCH, MOMENTARY	507319	89536	507319	16		

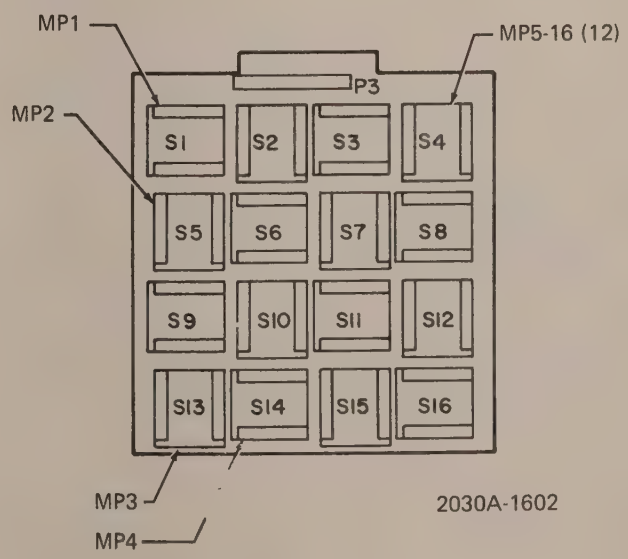


Figure 5-5. A3 Keyboard · CB Assembly

Table 5-6. A4 PTI System Interface PCB Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
A4	Ⓟ PTI SYSTEM INTERFACE PCB ASSEMBLY FIGURE 5-6 (2030A-4003T)	490151	89536	490151	REF		
C1	CAP, PLYSTRN, 0.10 UF +/-10%, 100V	393439	73445	C280MAH/A100K	1		
C2	CAP, TA, 1.0 UF +/-20%, 35A	161919	56289	196D105X0035JA1	1		
C3	CAP, CER, 20 PF +/-10%, 500V	106369	79282	831-000-T2H0-200K	2		
C4	CAP, CER, 20 PF +/-10%, 500V	106369	79282	831-000-T2H0-200K	REF		
C5	CAP, TA, 39 UF +/-20%, 6V	163915	56289	196D396X0006KA1	2		
C6	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	3		
C7	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
C8	CAP, CER, 0.22 UF +/-20%, 50V	309849	71590	CW30C224K	REF		
C9	CAP, TA, 39 UF +/-20%, 6V	163915	56289	196D396X0006KA1	REF		
H1	SCREW, TH/FORM, 3/8" (NOT SHOWN)	448456	89536	448456	2		
H1.	--(UNDER J6 CONNECTOR)						
J3	SOCKET, CONNECTOR	512293	00779	1-583773-5	1		
J6	CONNECTOR, 36-PIN	493783	00779	552743-1	1		
J7	SOCKET, CONNECTOR, 18-POS	435024	00779	583773-8	1		
MP1/MP2	SOCKET, 24-PIN, DIL	418970	91506	324AG37D	2		
MP3	SOCKET, IC, 40-PIN, DIL	418988	91506	340-AG39D	1		
MP4	HOLDER, COMPONENT (RUBBER)	422865	98159	2829-75-2	1		
Q1	XSTR, SI, NPN	218396	07910	2N3804	1	1	
R1	RES, DEP. CAR, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K	1		
R2	RES, DEP. CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	4		
R3	RES, DEP. CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R4	RES, DEP. CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R5	RES, DEP. CAR, 1.2 +/-5%, 1/4W	442004	80031	CR251-4-5P1E2	1		
R6	RES, DEP. CAR, 51K +/-5%, 1/4W	376434	80031	CR251-4-5P51K	1		
R7	RES, DEP. CAR, 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R8	RES, DEP. CAR, 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100K	1		
S1	SWITCH, SPST, DIP	495218	00779	435802-3	3		
S2	SWITCH, SPST, DIP	495218	00779	435802-3	REF		
S3	SWITCH, SPST, DIP	495218	00779	435802-3	REF		
TB1	TERMINAL BLOCK	479006	89536	479006	1		
U1	Ⓟ IC, C-MOS, TRI-ST, HEX NON-INVRT BUFFERS	407759	04713	MC14503CP	5	1	
U3	Ⓟ IC, C-MOS, TRI-ST, HEX NON-INVRT BUFFERS	407759	04713	MC14503CP	REF		
U5	Ⓟ IC, C-MOS, TRI-ST, HEX NON-INVRT BUFFERS	407759	04713	MC14503CP	REF		
U6	Ⓟ IC, C-MOS, 16 KEY ENCODER	483925	12040	MM74C922N	1	1	
U9	Ⓟ IC, C-MOS, TRI-ST, HEX NON-INVRT BUFFERS	407759	04713	MC14503CP	REF		
U10	Ⓟ IC, C-MOS, QUAD, "D" LATCH 16-PIN DIP	355149	02735	CD4042AE	3	1	
U11	Ⓟ IC, C-MOS, HEX INVERTER	404681	04713	MC1406BCP	1	1	
U13	Ⓟ IC, C-MOS, TRI-ST, HEX NON-INVRT BUFFERS	407759	04713	MC14503CP	REF		
U14	Ⓟ IC, C-MOS, BCD TO DECODER, 16-PIN DIP	407981	12040	MM74C42N	1	1	
U15	Ⓟ IC, C-MOS, QUAD, "D" LATCH 16-PIN DIP	355149	02735	CD4042AE	REF		
U16	Ⓟ IC, C-MOS, QUAD, "D" LATCH 16-PIN DIP	355149	02735	CD4042AE	REF		
U17	INSTALLED IN TEST				1	1	1
U18	INSTALLED IN TEST				1	1	1
U19	INSTALLED IN TEST				1	1	1
XJ20	SOCKET, CONNECTOR	485045	30035	SS-109-1-20C	2		
XJ21	SOCKET, CONNECTOR	485045	30035	SS-109-1-20C	REF		
Y1	CRYSTAL, 6 MHZ	461665	89536	461665	1		

Table 5-6. A4 PTI System Interface PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
Z1	RES, NETWORK, 100K	412908	89536	412908	2		
Z2	RES, NETWORK, 100K	412726	89536	412736	1		
Z3	RES, NETWORK, 100K	412908	89536	412908	REF		
Z4	RES, NETWORK, 10K	500710	89536	500710	1		
Z5	RES, NETWORK, 100K	461038	89536	461038	1		

1 ORDER BY COMPLETE INFORMATION APPEARING ON TOP OF THE EXISTING IC. INCLUDE REFERENCE DESIGNATOR.

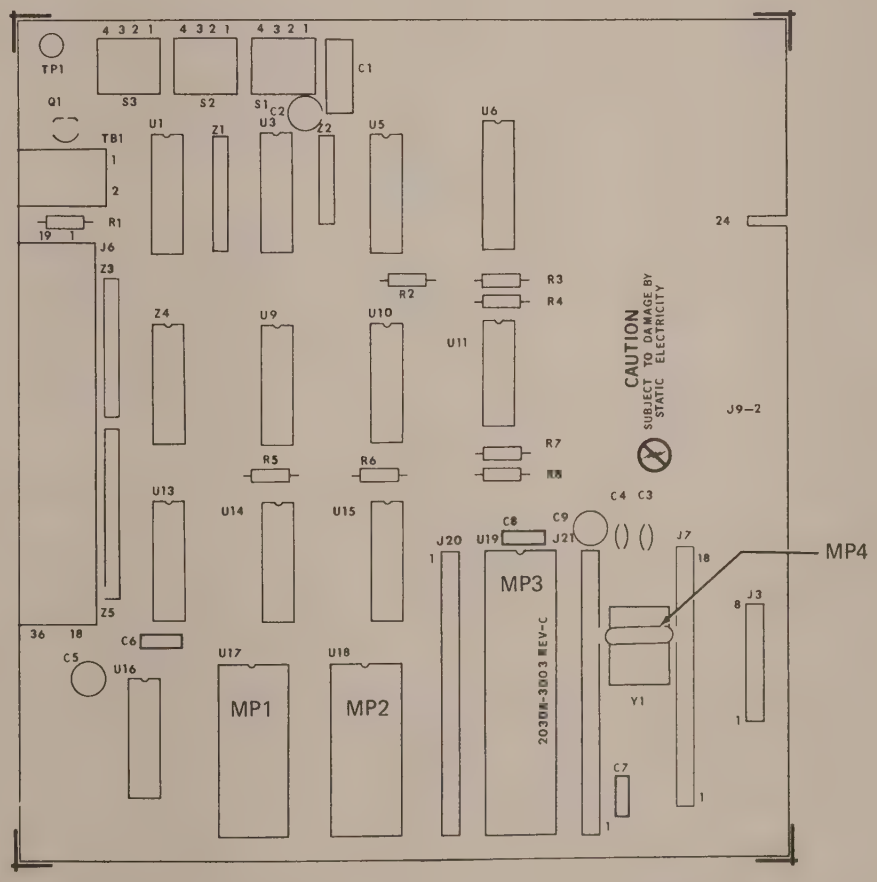


Figure 5-6. A4 PTI System Interface PCB Assembly

Section 6
Option & Accessory Information

6-1. INTRODUCTION

6-2. This section of the manual contains information concerning accessories available for use with the Model 2030A Programmable Printer. There are no options available for the 2030A. Each accessory is described briefly in this section. Complex accessories (Y2028, Y2034) are further documented in individual manuals provided with the accessory when purchased.

6-3. Five accessories are available for use with the 2030A Programmable Printer: two cable assemblies (Y7203, Y7204), a Rack Panel (Y2016 or Y2017), an Interface, BCD to PTI (Y2028), and an Interconnect Accessory (Y2034). The Interface (BCD to PTI) and the Interconnect Accessory are documented in separate manuals supplied with the accessory when purchased.

6-4. CABLE ASSEMBLIES

6-5. Both cable assemblies are direct pin-to-pin cables for use in connecting digital test instruments to the 2030A. Both cables have a 36 pin Amp "Champ" Series male connector on one end, and a 36 pin Amp "Champ" Series female connector on the other end. The two available cable assemblies differ only in length; the Y7203 cable is two feet long, and the Y7204 cable is five feet long.

6-6. RACK PANELS

6-7. A rack panel kit is available for use in mounting the Model 2030A Programmable Printer in a standard 19-inch electronics rack. A single D size panel (Y2016) is available to mount one instrument. A double D size panel (Y2017) is available to mount two instruments in a 19-inch electronics equipment rack.

6-8. INTERFACE (BCD to PTI)

6-9. Accessory Y2028 is an interface that converts BCD input data to ASCII format output data compatible with the Fluke PTI system printers. It also isolates the test instrument from the printer input. It may be used to interface BCD format instruments, with the Parallel BCD Output Option, to the Model 2030A Programmable Printer. The Y2028 is packaged in an "A" size PTI case which may be stacked and latched to additional PTI case instruments to form a portable test system. Case dimensions are: 13.08 cm high, 20.45 cm wide, and 32.64 cm deep. Input data is received through 100 card-edge connections on the rear panel. The input is plug compatible with the 2210 series interface cables.

6-10. A cable-mounted 36 pin female Amp "Champ" Series connector provides plug compatible output connection to the 2030A Programmable Printer. To connect one BCD instrument in combination with one or more PTI instruments, the BCD instrument may be connected to the Y2028 and the Y2028 may then be connected to one input of the Y2034. The Y2034 Interconnect Accessory supplies printer input from all connected instruments, including the BCD instrument/Interface combination.

6-11. The Model Y2034 Interface (BCD to PTI) meets all temperature, humidity, and vibration specifications listed for the 2030A Programmable Printer. Additional specifications are listed in Table 6-1. For additional Y2028 information, refer to the Model Y2028 Interface (BCD to PTI) Instruction Manual.

6-12. INTERCONNECT ACCESSORY

6-13. The Model Y2034 Interconnect Accessory provides multiple input capability for Model 2030A Programmable Printers. It also has a storage drawer for customer use.

Table 6-1. Y2028 Specifications

INPUT CONNECTIONS	100 card-edge pins
OUTPUT CONNECTOR	36-pin, Cable Mounted
INPUT DATA FORMAT	Parallel BCD
OUTPUT DATA FORMAT	ASCII
PLUG COMPATIBLE	2020A/2021A, With Option –01 or –04. 2030A, Y2034

6-14. All input and output data must be in the PTI compatible format. Five PTI format, digital test instruments may be connected to the five male connectors using Cable Accessories Y7203 or Y7204. One female output connector may be connected to the printer using either Cable Accessory. Pins 1 through 18 of all input connectors and pins 1 through 18 of the output connector are bussed together. Pins 19 through 36 of all connectors are open.

6-15. The Model Y2034 Interconnect Accessory meets all temperature, humidity, and vibration specifications listed for the Model 2030A Printer. Additional specifications are listed in Table 6-2.

Table 6-2. Y2034 Specifications

INPUT CONNECTORS	5; 36-pin male
OUTPUT CONNECTOR	1; 36-pin female
INPUT DATA FORMAT OUTPUT DATA FORMAT	Passive Device No Signal Changes
PLUG COMPATIBLE	All Fluke PTI Format Instruments, Y2028

Section 7
General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the List of Replaceable Parts contained in Section 5.

List of Abbreviations and Symbols

A or amp	ampere
ac	alternating current
af	audio frequency
a/d	analog-to-digital
assy	assembly
AWG	american wire gauge
B	bel
bcd	binary coded decimal
°C	Celsius
cap	capacitor
ccw	counterclockwise
cer	ceramic
cermet	ceramic to metal(seal)
ckt	circuit
cm	centimeter
cmrr	common mode rejection ratio
comp	composition
cont	continue
crt	cathode-ray tube
cw	clockwise
d/a	digital-to-analog
dac	digital-to-analog converter
dB	decibel
dc	direct current
dmm	digital multimeter
dvm	digital voltmeter
elect	electrolytic
ext	external
F	farad
°F	Fahrenheit
FET	Field-effect transistor
ff	flip-flop
freq	frequency
FSN	federal stock number
g	gram
G	giga (10^9)
gd	guard
Ge	germanium
GHz	gigahertz
gmv	guaranteed minimum value
gnd	ground
H	henry
hd	heavy duty
hf	high frequency
Hz	hertz
IC	integrated circuit
if	intermediate frequency
in	inch(es)
intl	internal
I/O	input/output
k	kilo (10^3)
kHz	kilohertz
kΩ	kilohm(s)
kV	kilovolt(s)
lf	low frequency
LED	light-emitting diode
LSB	least significant bit
LSD	least significant digit
M	mega (10^6)
m	milli (10^{-3})
mA	milliampere(s)
max	maximum
mf	metal film
MHz	megahertz
min	minimum
mm	millimeter
ms	millisecond
MSB	most significant bit
MSD	most significant digit
MTBF	mean time between failures
MTTR	mean time to repair
mV	millivolt(s)
mv	multivibrator
MΩ	megohm(s)
n	nano (10^{-9})
na	not applicable
NC	normally closed
(-) or neg	negative
NO	normally open
ns	nanosecond
opnl ampl	operational amplifier
p	pico (10^{-12})
para	paragraph
pcb	printed circuit board
pF	picofarad
pn	part number
(+) or pos	positive
pot	potentiometer
p-p	peak-to-peak
ppm	parts per million
PROM	programmablle read-only memory
psi	pound-force per square inch
RAM	random-access memory
rf	radio frequency
rms	root mean square
ROM	read-only memory
s or sec	second (time)
scope	oscilloscope
SH	shield
Si	silicon
serno	serial number
sr	shift register
Ta	tantalum
tb	terminal board
tc	temperature coefficient or temperature compensating
tcxo	temperature compensated crystal oscillator
tp	test point
u or μ	micro (10^{-6})
uhf	ultra high frequency
us or μs	microsecond(s) (10^{-6})
uut	unit under test
V	volt
v	voltage
var	variable
vco	voltage controlled oscillator
vhf	very high frequency
vlf	very low frequency
W	watt(s)
ww	wire wound
xfmr	transformer
xstr	transistor
xtal	crystal
xtlo	crystal oscillator
Ω	ohm(s)
μ	micro (10^{-6})

Federal Supply Codes for Manufacturers

00213
Nytronics Comp. Group Inc.
Subsidiary of Nytronics Inc.
Formerly Sage Electronics
Rochester, New York

00327
Welwyn International, Inc.
Westlake, Ohio

00656
Aerovox Corp.
New Bedford, Massachusetts

00686
Film Capacitors, Inc.
Passaic, New Jersey

00779
AMP Inc.
Harrisburg, Pennsylvania

01121
Allen-Bradley Co.
Milwaukee, Wisconsin

01281
TRW Electronic Comp.
Semiconductor Operations
Lawndale, California

01295
Texas Instruments, Inc.
Semiconductor Group
Dallas, Texas

01537
Motorola Communications &
Electronics Inc.
Franklin Park, Illinois

01686
RCL Electronics Inc.
Manchester, New Hampshire

01730
Replaced by 73586

01884
Use 56289
Sprague Electric Co.
Dearborn Electronic Div.
Lockwood, Florida

02114
Ferroxcube Corp.
Saugerties, New York

02131
General Instrument Corp.
Harris ASW Div.
Westwood, Maine

02395
Rason Mfg. Co.
Brooklyn, New York

02533
Snelgrove, C.R. Co., Ltd.
Don Mills, Ontario, Canada
M3B 1M2

02606
Fenwal Labs
Div. of Travenal Labs.
Morton Grove, Illinois

02660
Bunker Ramo Corp., Conn Div.
Formerly Amphenol-Borg
Electric Corp.
Broadview, Illinois

02799
Areo Capacitors, Inc.
Chatsworth, California

03508
General Electric Co.
Semiconductor Products
Syracuse, New York

03614
Replaced by 71400

03651
Replaced by 44655

03797
Eldema Div.
Genisco Technology Corp.
Compton, California

03877
Transistron Electronic Corp.
Wakefield, Massachusetts

03888
KDI Pyrofilm Corp.
Whippany, New Jersey

03911
Clairex Electronics Div.
Clairex Corp.
Mt. Vernon, New York

03980
Muirhead Inc.
Mountainside, New Jersey

04009
Arrow Hart Inc.
Hartford, Connecticut

04062
Replaced by 72136

04202
Replaced by 81312

04217
Essex International Inc.
Wire & Cable Div.
Anaheim, California

04221
Aemco, Div. of
Midtex Inc.
Mankato, Minnesota

04222
AVX Ceramics Div.
AVX Corp.
Myrtle Beach, Florida

04423
Telonic Industries
Laguna Beach, California

04645
Replaced by 75376

04713
Motorola Inc. Semiconductor
Products
Phoenix, Arizona

04946
Standard Wire & Cable
Los Angeles, California

05082
Replaced by 94988

05236
Jonathan Mfg. Co.
Fullerton, California

05245
Components Corp. now
Corcom, Inc.
Chicago, Illinois

05277
Westinghouse Electric Corp.
Semiconductor Div.
Youngwood, Pennsylvania

05278
Replaced by 43543

05279
Southwest Machine &
Plastic Co.
Glendora, California

05397
Union Carbide Corp.
Materials Systems Div.
New York, New York

05571
Use 56289
Sprague Electric Co.
Pacific Div.
Los Angeles, California

05574
Viking Industries
Chatsworth, California

05704
Replaced by 16258

05820
Wakefield Engineering Inc.
Wakefield, Massachusetts

06001
General Electric Co.
Electronic Capacitor &
Battery Products Dept.
Columbia, South Carolina

06136
Replaced by 63743

06383
Panduit Corp.
Tinley Park, Illinois

06473
Bunker Ramo Corp.
Amphenol SAMS Div.
Chatsworth, California

06555
Beede Electrical Instrument Co.
Penacook, New Hampshire

06739
Electron Corp.
Littleton, Colorado

06743
Clevite Corp.
Cleveland, Ohio

06751
Components, Inc. Semcor Div.
Phoenix, Arizona

06860
Gould Automotive Div.
City of Industry, California

06961
Vernitron Corp., Piezo
Electric Div.
Formerly Clevite Corp., Piezo
Electric Div.
Bedford, Ohio

06980
Eimac Div.
Varian Associates
San Carlos, California

07047
The Ross Milton Co.
South Hampton, Pennsylvania

07115
Replaced by 14674

07138
Westinghouse Electric Corp.,
Electronic Tube Div.
Horsehead, New York

07233
TRW Electronic Components
Cinch Graphic
City of Industry, California

07256
Silicon Transistor Corp.
Div. of BBF Group Inc.
Chelmsford, Massachusetts

07261
Aumet Corp.
Culver City, California

07263
Fairchild Semiconductor
Div. of Fairchild Camera
& Instrument Corp.
Mountain View, California

07344
Bircher Co., Inc.
Rochester, New York

07597
Burndy Corp.
Tape/Cable Div.
Rochester, New York

07792
Lerma Engineering Corp.
Northampton, Massachusetts

07910
Teledyne Semiconductor
Formerly Continental Device
Hawthorne, California

07933
Use 49956
Raytheon Co.
Semiconductor Div. HQ
Mountain View, California

08225
Industro Transistor Corp.
Long Island City, New York

Federal Supply Codes for Manufacturers (cont)

08261
Spectra Strip Corp.
Garden Grove, California

08530
Reliance Mica Corp.
Brooklyn, New York

08806
General Electric Co.
Miniature Lamp Products Dept
Cleveland, Ohio

08863
Nylomatic Corp.
Norrisville, Pennsylvania

08988
Use 53085
Skottie Electronics Inc.
Archbald, Pennsylvania

09214
G.E. Co. Semi-Conductor
Products Dept.
Power Semi-Conductor
Products OPN Sec.
Auburn, New York

09353
C and K Components
Watertown, Massachusetts

09423
Scientific Components, Inc.
Santa Barbara, California

09922
Burndy Corp.
Norwalk, Connecticut

09969
Dale Electronics Inc.
Yankton, S. Dakota

10059
Barker Engineering Corp.
Formerly Amerace, Amerace
ESNA Corp.
Kenilworth, New Jersey

11236
CTS of Berne
Berne, Indiana

11237
CTS Keene Inc.
Paso Robles, California

11358
CBS Electronic Div.
Columbia Broadcasting System
Newburyport, Minnesota

11403
Best Products Co.
Chicago, Illinois

11503
Keystone Columbia Inc.
Warren, Michigan

11532
Teledyne Relays
Hawthorne, California

11711
General Instrument Corp.
Rectifier Division
Hicksville, New York

11726
Qualidyne Corp.
Santa Clara, California

12014
Chicago Rivet & Machine Co.
Bellwood, Illinois

12040
National Semiconductor Corp.
Danburry, Connecticut

12060
Diodes, Inc.
Chatsworth, California

12136
Philadelphia Handle Co.
Camden, New Jersey

12300
Potter-Brumfield Div.
AMF Canada LTD.
Guelph, Ontario, Canada

12323
Presin Co., Inc.
Shelton, Connecticut

12327
Freeway Corp. formerly
Freeway Washer & Stamping Co.
Cleveland, Ohio

12443
The Budd Co. Polychem Products
Plastic Products Div.
Bridgeport, Pennsylvania

12615
U.S. Terminals Inc.
Cincinnati, Ohio

12617
Hamlin Inc.
Lake Mills, Wisconsin

12697
Clarostat Mfg. Co.
Dover, New Hampshire

12749
James Electronics
Chicago, Illinois

12856
Micrometals
Sierra Madre, California

12954
Dickson Electronics Corp.
Scottsdale, Arizona

12969
Unitrode Corp.
Watertown, Massachusetts

13103
Thermalloy Co., Inc.
Dallas, Texas

13327
Solitron Devices Inc.
Tappan, New York

13511
Amphenol Cadre Div.
Bunker-Ramo Corp.
Los Gatos, California

13606
Use 56289
Sprague Electric Co.
Transistor Div.
Concord, New Hampshire

13839
Replaced by 23732

14099
Semtech Corp.
Newbury Park, California

14140
Edison Electronic Div.
Mc Gray-Edison Co.
Manchester, New Hampshire

14193
Cal-R-Inc. formerly
California Resistor, Corp.
Santa Monica, California

14298
American Components, Inc.
an Insilco Co.
Conshohocken, Pennsylvania

14655
Cornell-Dublier Electronics
Division of Federal Pacific
Electric Co. Govt. Control Dept.
Newark, New Jersey

14752
Electro Cube Inc.
San Gabriel, California

14869
Replaced by 96853

14936
General Instrument Corp.
Semi Conductor Products Group
Hicksville, New York

15636
Elec-Trol Inc.
Saugus, California

15801
Fenwal Electronics Inc.
Div. of Kidde Walter and Co., Inc.
Framingham, Massachusetts

15818
Teledyne Semiconductors,
formerly Amelco Semiconductor
Mountain View, California

15849
Litton Systems Inc. Useco Div.
formerly Useco Inc.
Van Nuys, California

15898
International Business
Machines Corp.
Essex Junction, Vermont

15909
Replaced by 14140

16258
Space-Lok Inc.
Burbank, California

16299
Corning Glass
Electronic Components Div.
Raleigh, North Carolina

16332
Replaced by 28478

16473
Cambridge Scientific Ind.
Div. of Chemed Corporation
Cambridge, Maryland

16742
Paramount Plastics
Fabricators, Inc.
Downey, California

16758
Delco Electronics
Div. of General Motors Corp.
Kokomo, Indiana

17001
Replaced by 71468

17069
Circuit Structures Lab.
Burbank, California

17338
High Pressure Eng. Co., Inc.
Oklahoma City, Oklahoma

17545
Atlantic Semiconductors, Inc.
Asbury Park, New Jersey

17856
Siliconix, Inc.
Santa Clara, California

17870
Replaced by 14140

18178
Vactec Inc.
Maryland Heights, Missouri

18324
Signetics Corp.
Sunnyvale, California

18612
Vishay Resistor Products Div.
Vishay Intertechnology Inc.
Malvern, Pennsylvania

18736
Voltronics Corp.
Hanover, New Jersey

18927
GTE Sylvania Inc.
Precision Material Group
Parts Division
Titusville, Pennsylvania

19451
Perine Machinery & Supply Co.
Seattle, Washington

19701
Electro-Midland Corp.
Mepco-Electra Inc.
Mineral Wells, Texas

20584
Enochs Mfg. Inc.
Indianapolis, Indiana

Federal Supply Codes for Manufacturers (cont)

20891
Self-Organizing Systems, Inc.
Dallas, Texas

21604
Bucheye Stamping Co.
Columbus, Ohio

21845
Solitron Devices Inc.
Transistor Division
Riveria Beach, Florida

22767
ITT Semiconductors
Palo Alto, California

23050
Product Comp. Corp.
Mount Vernon, New York

23732
Tracor Inc.
Rockville, Maryland

23880
Stanford Applied Engrng.
Santa Clara, California

23936
Pamotor Div., Wm. J. Purdy Co.
Burlingame, California

24248
Replaced by 94222

24355
Analog Devices Inc.
Norwood, Massachusetts

24655
General Radio
Concord, Massachusetts

24759
Lenox Fugle Electronics Inc.
South Plainfield, New Jersey

25088
Siemen Corp.
Isilen, New Jersey

25403
Amperex Electronic Corp.
Semiconductor &
Micro-Circuits Div.
Slatersville, Rhode Island

27014
National Semiconductor Corp.
Santa Clara, California

27264
Molex Products
Downers Grove, Illinois

28213
Minnesota Mining & Mfg. Co.
Consumer Products Div.
St. Paul, Minnesota

28425
Serv-/-Link formerly
Bohannan Industries
Fort Worth, Texas

28478
Deltrol Controls Div.
Deltrol Corporation
Milwaukee, Wisconsin

28480
Hewlett Packard Co.
Corporate HQ
Palo Alto, California

28520
Heyman Mfg. Co.
Kenilworth, New Jersey

29083
Monsanto, Co., Inc.
Santa Clara, California

29604
Stackpole Components Co.
Raleigh, North Carolina

30148
AB Enterprise Inc.
Ahoskie, North Carolina

30323
Illinois Tool Works, Inc.
Chicago, Illinois

31091
Optimax Inc.
Colmar, Pennsylvania

32539
Mura Corp.
Great Neck, New York

32767
Griffith Plastic Corp.
Burlingame, California

32879
Advanced Mechanical
Components
Northridge, California

32897
Erie Technological Products, Inc.
Frequency Control Div.
Carlisle, Pennsylvania

32997
Bourns Inc.
Trimpot Products Division
Riverside, California

33173
General Electric Co.
Products Dept.
Owensboro, Kentucky

34333
Silicon General
Westminister, California

34335
Advanced Micro Devices
Sunnyvale, California

34802
Electromotive Inc.
Kenilworth, New Jersey

37942
P.R. Mallory & Co., Inc.
Indianapolis, Indiana

42498
National Radio
Melrose, Massachusetts

43543
Nytronics Inc.
Transformer Co. Div.
Geneva, New York

44655
Ohmite Mfg. Co.
Skokie, Illinois

49671
RCA Corp.
New York, New York

49956
Raytheon Company
Lexington, Massachusetts

50088
Mostek Corp.
Carrollton, Texas

50579
Litronix Inc.
Cupertino, California

51605
Scientific Components Inc.
Linden, New Jersey

53021
Sangamo Electric Co.
Springfield, Illinois

54294
Cutler-Hammer Inc. formerly
Shallcross, A Cutter-Hammer Co.
Selma, North Carolina

55026
Simpson Electric Co.
Div. of Am. Gage and Mach. Co.
Elgin, Illinois

56289
Sprague Electric Co.
North Adams, Massachusetts

58474
Superior Electric Co.
Bristol, Connecticut

60399
Torin Corp. formerly
Torrington Mfg. Co.
Torrington, Connecticut

63743
Ward Leonard Electric Co., Inc.
Mount Vernon, New York

64834
West Mfg. Co.
San Francisco, California

65092
Weston Instruments Inc.
Newark, New Jersey

66150
Winslow Tele-Tronics Inc.
Eaton Town, New Jersey
70485
Atlantic India Rubber Works
Chicago, Illinois

70563
Amperite Company
Union City, New Jersey

70903
Belden Corp.
Geneva, Illinois

71002
Birnback Radio Co., Inc.
Freeport, New York

71400
Bussmann Mfg.
Div. of McGraw-Edison Co.
Saint Louis, Missouri

71450
CTS Corp.
Elkhart, Indiana

71468
ITT Cannon Electric Inc.
Santa Ana, California

71482
Clare, C.P. & Co.
Chicago, Illinois

71590
Centrelab Electronics
Div. of Globe Union Inc.
Milwaukee, Wisconsin

71707
Coto Coil Co., Inc.
Providence, Rhode Island

71744
Chicago Miniature Lamp Works
Chicago, Illinois

71785
TRW Electronics Components
Cinch Connector Operations Div.
Elk Grove Village
Chicago, Illinois

72005
Wilber B. Driver Co.
Newark, New Jersey

72092
Replaced by 06980

72136
Electro Motive Mfg. Co.
Williamantic, Connecticut

72259
Nytronics Inc.
Pelham Manor, New Jersey

72619
Dialight Div.
Amperex Electronic Corp.
Brooklyn, New York

72653
G.C. Electronics
Div. of Hydrometals, Inc.
Brooklyn, New York

72665
Replaced by 90303
72794
Dzus Fastener Co., Inc.
West Islip, New York

72928
Gulton Ind. Inc.
Gudeman Div.
Chicago, Illinois

Federal Supply Codes for Manufacturers (cont)

72982
Erie Tech. Products Inc.
Erie, Pennsylvania

73138
Bechman Instrument Inc.
Helipot Division
Fullerton, California

73293
Hughes Aircraft Co.
Electron Dynamics Div.
Torrance, California

73445
Amperex Electronic Corp.
Hicksville, New York

73559
Carling Electric Inc.
West Hartford, Connecticut

73586
Circle F Industries
Trenton, New Jersey

73734
Federal Screw Products, Inc.
Chicago, Illinois

73743
Fischer Special Mfg. Co.
Cincinnati, Ohio

73899
JFD Electronics Co.
Components Corp.
Brooklyn, New York

73949
Guardian Electric Mfg. Co.
Chicago, Illinois

74199
Quan Nichols Co.
Chicago, Illinois

74217
Radio Switch Corp.
Marlboro, New Jersey

74276
Signalite Div.
General Instrument Corp.
Neptune, New Jersey

74306
Piezo Crystal Co.
Carlisle, Pennsylvania

74542
Hoyt Elect. Instr. Works
Penacook, New Hampshire

74970
Johnson E.F., Co.
Waseca, Minnesota

75042
TRW Electronics Components
IRC Fixed Resistors
Philadelphia, Pennsylvania

75376
Kurz-Kasch Inc.
Dayton, Ohio

75378
CTS Knights Inc.
Sandwich, Illinois

75382
Kulka Electric Corp.
Mount Vernon, New York

75915
Littlefuse Inc.
Des Plaines, Illinois

76854
Oak Industries Inc.
Switch Div.
Crystal Lake, Illinois

77342
AMF Inc.
Potter & Brumfield Div.
Princeton, Indiana

77638
General Instrument Corp.
Rectifier Division
Brooklyn, New York

77969
Rubbercraft Corp. of CA. LTD.
Torrance, California

78189
Shakeproof
Div. of Illinois Tool Works Inc.
Elgin, Illinois

78277
Sigma Instruments, Inc.
South Braintree, Massachusetts

78488
Stackpole Carbon Co.
Saint Marys, Pennsylvania

78553
Eaton Corp. Engineered
Fastener Div.
Tinnerman Plant
Cleveland, Ohio

79136
Waldes Kohinoor Inc.
Long Island City, New York

79497
Western Rubber Company
Goshen, Indiana

79963
Zierick Mfg. Corp.
Mt. Kisko, New York

80031
Electro-Midland Corp.
Mepco Div.
A North American Phillips Co.
Norristown, New Jersey

80145
LFE Corp., Process Control Div.
formerly API Instrument Co.
Chesterland, Ohio

80183
Use 56289
Sprague Products
North Adams, Massachusetts

80294
Bourns Inc., Instrument Div.
Riverside, California

80583
Hammarlund Mfg. Co., Inc.
Red Bank, New Jersey

80640
Arnold Stevens, Inc.
South Boston, Massachusetts

81073
Grayhill, Inc.
La Grange, Illinois

81312
Winchester Electronics
Div. of Litton Industries Inc.
Oakville, Connecticut

81483
Therm-O-Disc Inc.
Mansfield, Ohio

81483
International Rectifier Corp.
Los Angeles, California

81590
Korry Mfg. Co.
Seattle, Washington

81741
Chicago Lock Co.
Chicago, Illinois

82305
Palmer Electronics Corp.
South Gate, California

82389
Switchcraft Inc.
Chicago, Illinois

82415
North American Phillips
Controls Corp.
Frederick, Maryland

82872
Roanwell Corp.
New York, New York

82877
Rotron Inc.
Woodstock, New York

82879
ITT Royal Electric Div.
Pawtucket, Rhode Island

83003
Varo Inc.
Garland, Texas

83058
The Carr Co., United Can Div.
of TRW
Cambridge, Massachusetts

83298
Bendix Corp.
Electric Power Div.
Eatontown, New Jersey

83330
Herman H. Smith, Inc
Brooklyn, New York

83478
Rubbercraft Corp.
of America, Inc.
West Haven, Connecticut

83594
Burroughs Corp.
Electronic Components Div.
Plainfield, New Jersey

83740
Union Carbide Corp.
Battery Products Div.
formerly Consumer Products Div.
New York, New York

84171
Arco Electronics
Great Neck, New York

84411
TRW Electronic Components
TRW Capacitors
Ogallala, Nebraska

84613
Fuse Indicator Corp.
Rockville, Maryland

84682
Essex International Inc.
Industrial Wire Div.
Peabody, Massachusetts

86577
Precision Metal Products
of Malden Inc.
Stoneham, Massachusetts

86684
Radio Corp. of America
Electronic Components Div.
Harrison, New Jersey

86928
Seastrom Mfg. Co., Inc.
Glendale, California

87034
Illuminated Products Inc.
Subsidiary of Oak Industries Inc.
Anahiem, California

88219
Gould Inc.
Industrial Div.
Trenton, New Jersey

88245
Litton Systems Inc.
Useco Div.
Van Nuys, California

88419
Cornell-Dubilier Electronic Div.
Federal Pacific Co.
Fuquay-Varian, North Carolina

88486
Plastic Wire & Cable
Jewitt City, Connecticut

88690
Replaced by 04217

89536
John Fluke Mfg. Co., Inc.
Seattle, Washington

89730
G.E. Co., Newark Lamp Works
Newark, New Jersey

Federal Supply Codes for Manufacturers (cont)

90201
Mallory Capacitor Co.
Div. of P.R. Mallory Co., Inc.
Indianapolis, Indiana

90211
Use 56365
Square D Co.
Chicago, Illinois

90215
Best Stamp & Mfg. Co.
Kansas City, Missouri

90303
Mallory Battery Co.
Div. of Mallory Co., Inc.
Tarrytown, New York

91094
Essex International Inc.
Suglex/IWP Div.
Newmarket, New Hampshire

91293
Johanson Mfg. Co.
Boonton, New Jersey

91407
Replaced by 58474

91502
Associated Machine
Santa Clara, California

91506
Augat Inc.
Attleboro, Massachusetts

91637
Dale Electronics Inc.
Columbus, Nebraska

91662
Elco Corp.
Willow Grove, Pennsylvania

91737
Use 71468
Gremar Mfg. Co., Inc.
ITT Cannon/Gremar
Santa Ana, California

91802
Industrial Devices, Inc.
Edgewater, New Jersey

91833
Keystone Electronics Corp.
New York, New York

91836
King's Electronics Co., Inc.
Tuckahoe, New York

91929
Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934
Miller Electric Co., Inc.
Div. of Aunet
Woonsocket, Rhode Island

92194
Alpha Wire Corp.
Elizabeth, New Jersey

93332
Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145
Replaced by 49956

94154
Use 94988
Wagner Electric Corp.
Tung-Sol Div.
Newark, New Jersey

94222
Southco Inc. formerly
South Chester Corp.
Lester, Pennsylvania

95146
Alco Electronic Products Inc.
Lawrence, Massachusetts

95263
Leecraft Mfg. Co.
Long Island City, New York

95264
Replaced by 98278

95275
Vitramon Inc.
Bridgeport, Connecticut

95303
RCA Corp.
Receiving Tube Div.
Cincinnati, Ohio

95348
Gordo's Corp.
Bloomfield, New Jersey

95354
Methode Mfg. Corp.
Rolling Meadows, Illinois

95712
Bendix Corp.
Electrical Components Div.
Microwave Devices Plant
Franklin, Indiana

95987
Weckesser Co. Inc.
Chicago, Illinois

96733
San Fernando Electric Mfg. Co.
San Fernando, California

96853
Gulton Industries Inc.
Measurement and Controls Div.
formerly Rustrak Instruments Co.
Manchester, New Hampshire

96881
Thomson Industries, Inc.
Manhasset, New York

97540
Master Mobile Mounts, Div. of
Whitehall Electronics Corp.
Ft. Meyers, Florida

97913
Industrial Electronic
Hardware Corp.
New York, New York

97945
Penwalt Corp.
SS White Industrial Products Div.
Piscataway, New Jersey

97966
Replaced by 11358

98094
Replaced by 49956

98159
Rubber-Teck, Inc.
Gardena, California

98278
Malco A Microdot Co., Inc.
Connector & Cable Div.
Pasadena, California

98291
Sealectro Corp.
Mamaroneck, New York

98388
Royal Industries
Products Div.
San Diego, California

98743
Replaced by 12749

98925
Replaced by 14433

99120
Plastic Capacitors, Inc.
Chicago, Illinois

99217
Bell Industries Elect.
Comp. Div.
formerly Southern Elect. Div.
Burbank, California

99392
STM
Oakland, California

99515
ITT Jennings Monrovia Plant
Div. of ITT Jennings formerly
Marshall Industries Capacitor Div.
Monrovia, California

99779
Use 29587
Bunker-Ramo Corp.
Barnes Div.
Landsdowne, Pennsylvania

99800
American Precision Industries Inc.
Delevan Division
East Aurora, New York

99942
Centrelab Semiconductor
Centrelab Electronics Div. of
Globe-Union Inc.
El Monte, California

Toyo Electronics
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Irvine, California

National Connector
Minneapolis, Minnesota

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(312) 392-9510

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Appendix 7A
Manual Change Information

INTRODUCTION

This appendix contains information necessary to backdate the manual to conform with earlier pcb configurations. To identify the configuration of the pcb's used in your instrument, refer to the revision letter (marked in ink) on the component side of each pcb assembly. Table 7A-1 defines the assembly revision levels documented in this manual.

NEWER INSTRUMENTS

As changes and improvements are made to the instrument, they are identified by incrementing the revision letter marked on the affected pcb assembly. These changes are documented on a supplemental change/errata sheet which, when applicable, is inserted at the front of the manual.

OLDER INSTRUMENTS

To backdate this manual to conform with earlier assembly revision levels, perform the changes indicated in Table 7A-1.

CHANGES

There are no backdating changes at this printing. All pcb assemblies are documented at their original revision level.

Table 7A-1. Manual Status and Backdating Information

Ref Or Option No.	Assembly Name	Fluke Part No.	* To adapt manual to earlier rev configurations perform changes in desending order (by no.), ending with change under desired rev letter																						
			—	A	B	C	D	E	F	G	H	J	K	L	M	N	P								
A1	Final Assembly, 2030A	499434	X																						
A2	Printer PCB	490128	●	●	●	X																			
A3	Keyboard Assembly	490227	●	X																					
A4	PTI System Interface	490094	●	●	X																				

* X = The PCB revision levels documented in this manual.
● = These revision letters were never used in the instrument.
—= No revision letter on the PCB.

Section 8
Schematic Diagrams

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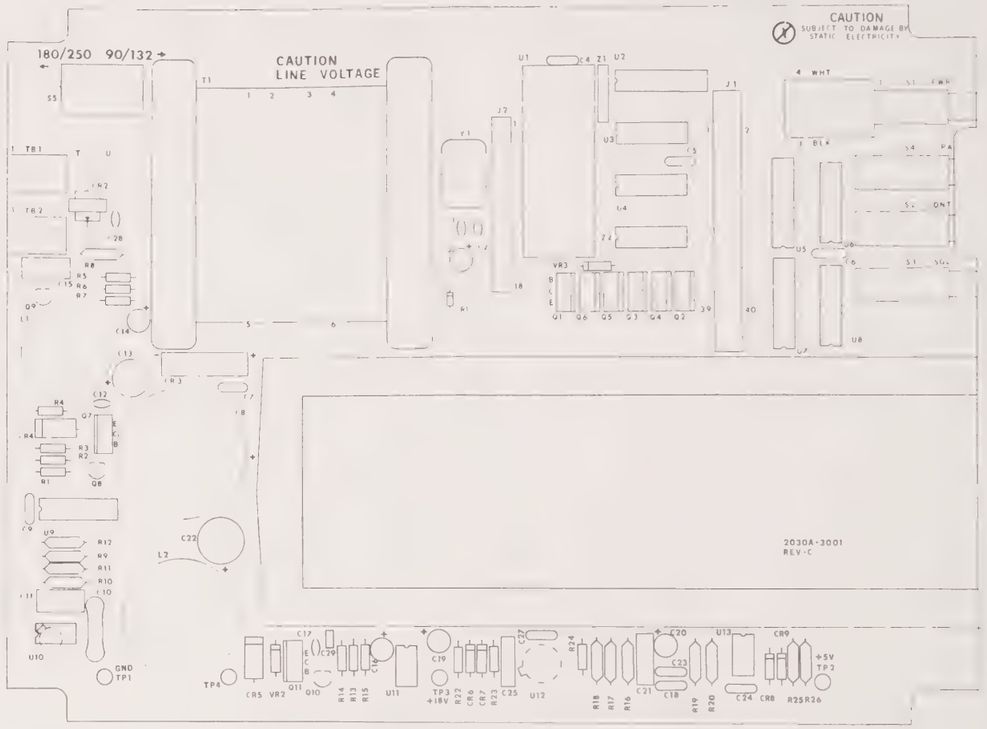
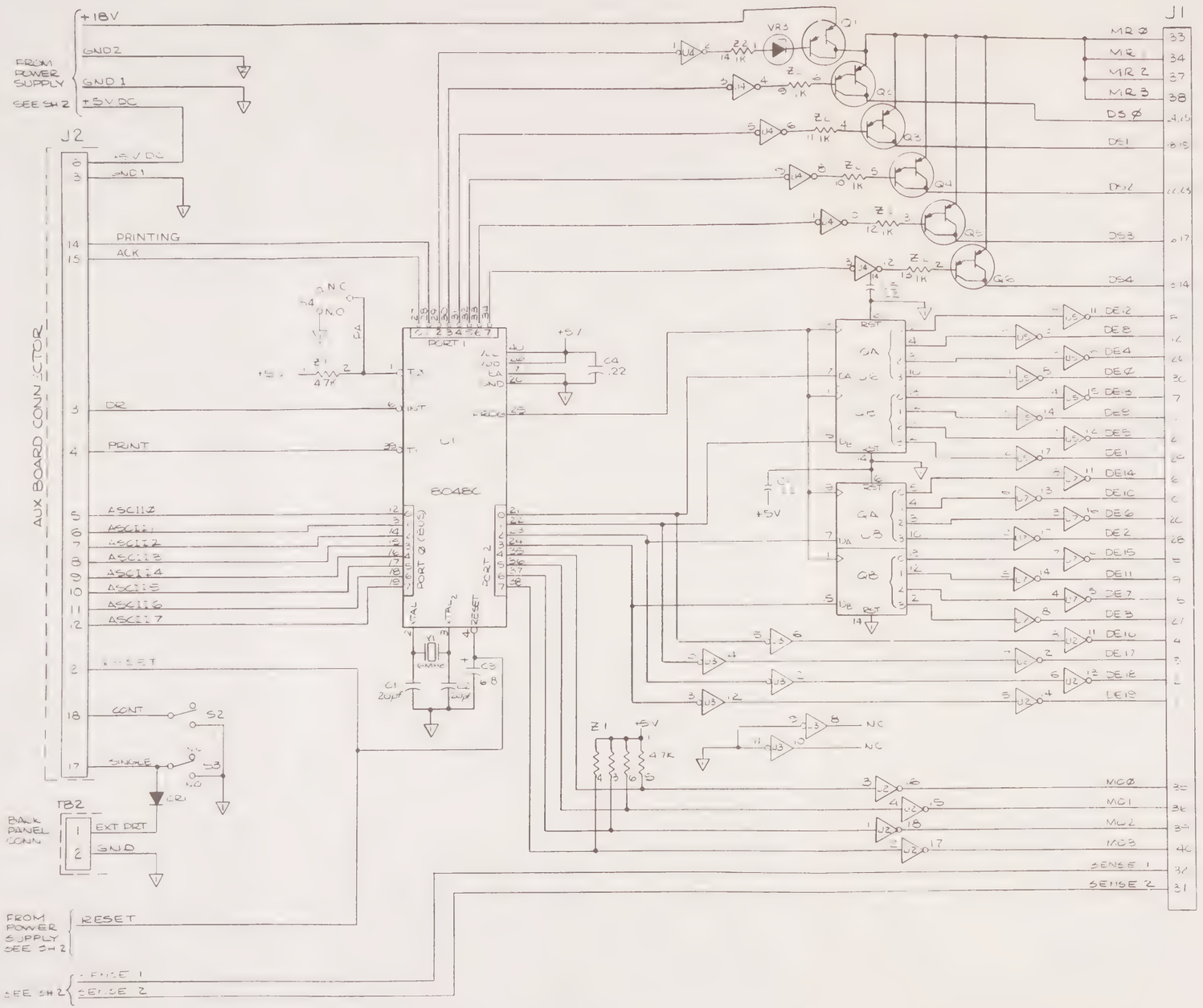
ACK	Acknowledge
ADR 0 - 3	Address (4-bits)
ADRVL	Address Valid
ALARM	Alarm Output
ASCII 0 - 7	ASCII Data (8-bits)
CONT	Continuous Print Command
DATA 0 - 7	Input Data (8-bits)
DATVL	Data Valid
DE 0 - 19	Digit Enable
DR	Data Ready
DS 0 - 4	Dot Strobe
DTACK	Data Acknowledge
EXT PRT	External Print Command
GND 1	Digital Common
GND 2	Power Common
MO 0 - 3	Motor Drive
MR 0 - 3	Motor Drive
PRINT	Print
PRINTING	Printing
RESET	Microprocessor Reset
SCNIP	Scan In Progress
SENSE 1	Printhead Thermistor
SENSE 2	Printhead Thermistor
SINGLE	Single Print Command

Figure 8-1. Mnemonics



2030A-1601

Figure 8-2. A1 Printer, Main PCB Assembly

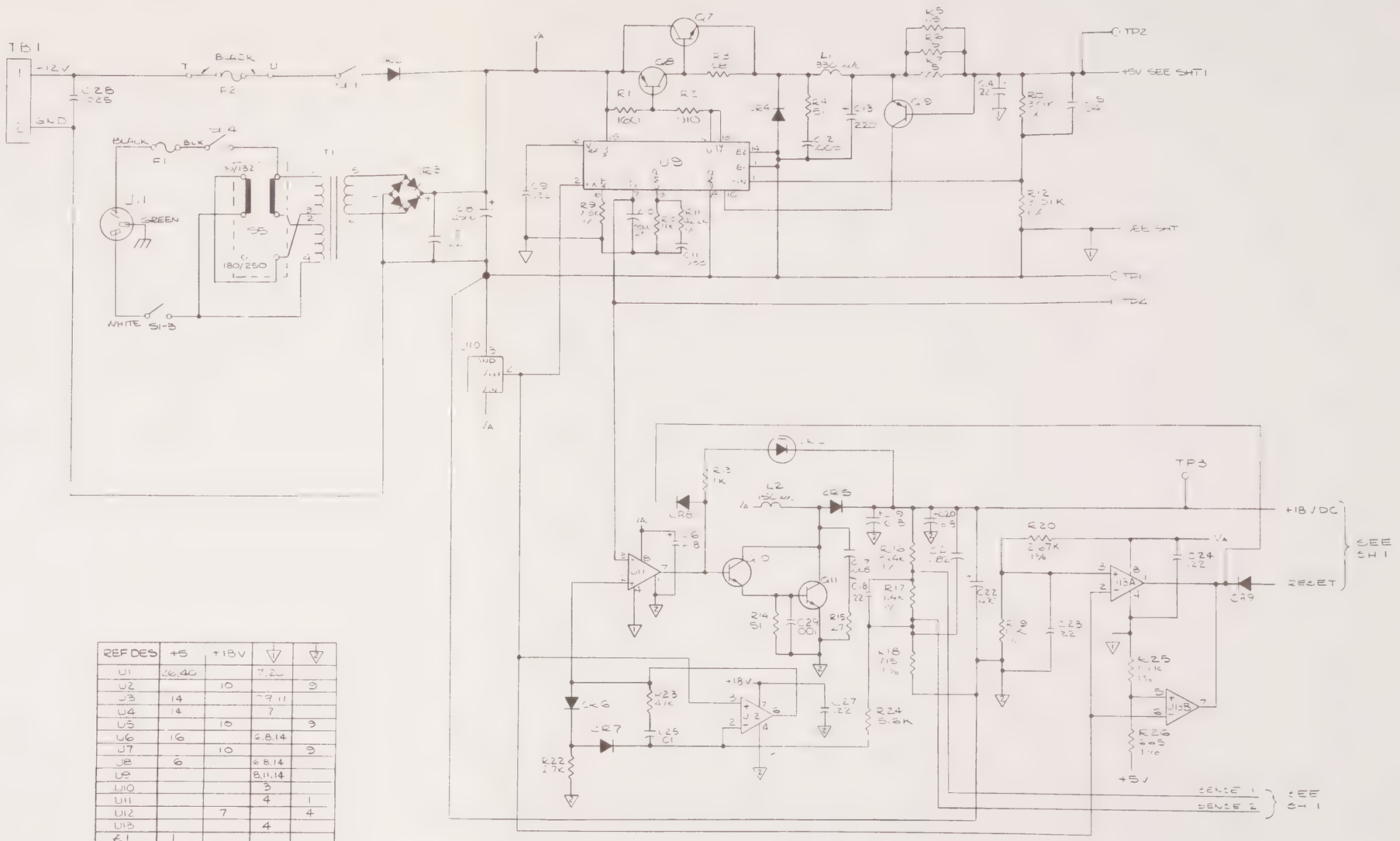


NOTES

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. ALL RESISTORS ARE ¼ W, 5% UNLESS OTHERWISE NOTED
3. ALL GRAPHIC SYMBOLS ARE IN ACCORDANCE WITH ANSI Y32.2 AND Y32.14.

2030A-1001 (1 of 2)

Figure 8-2. A1 Printer, Main PCB Assembly (cont)

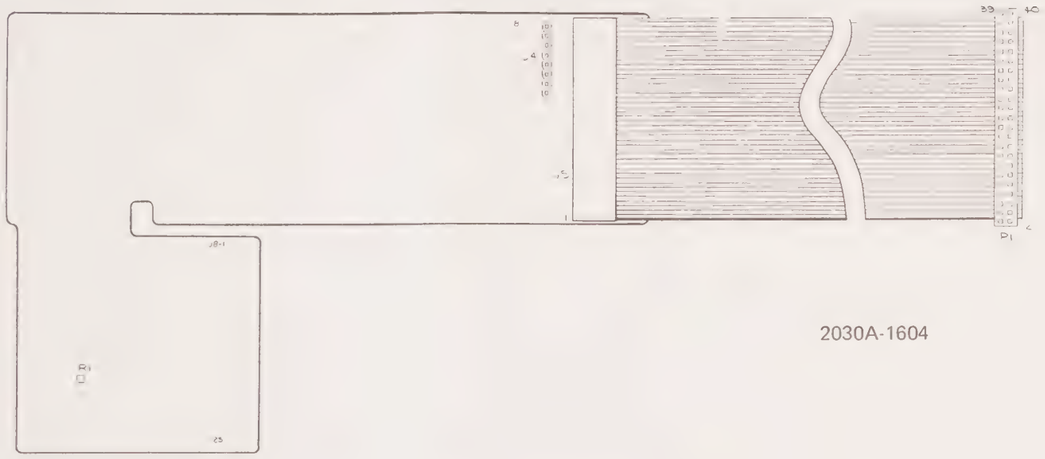


REF DES	+5	+18V	1	2
U1	16,40		7,2	
U2		10		9
U3	14		7,11	
U4	14		7	
U5		10		9
U6	16		2,8,14	
U7		10		9
U8	6		8,14	
U9			8,11,14	
U10			3	
U11			4	1
U12		7		4
U13			4	
Z1	1			

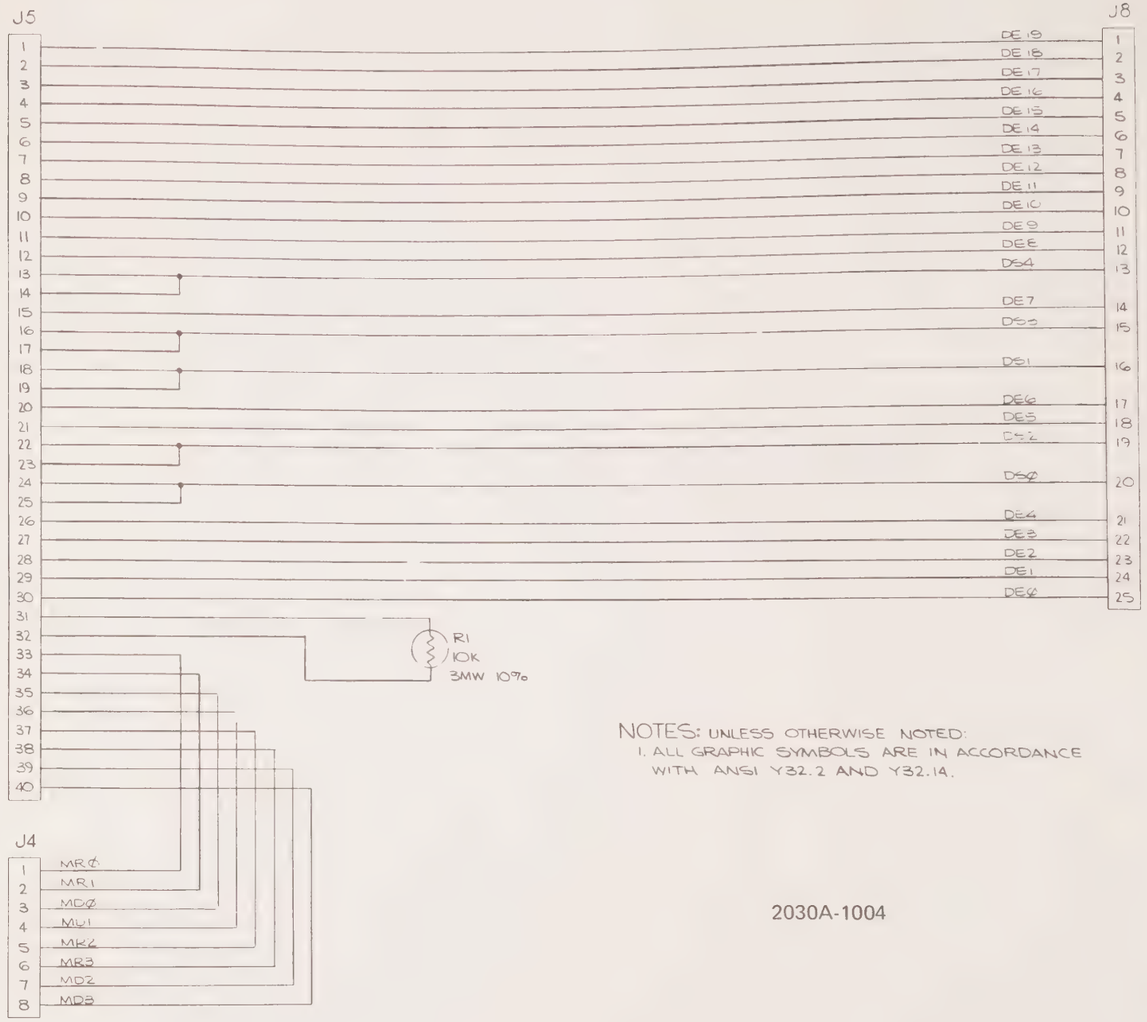
REF DES	
LAST USED	NOT USED
C29	R3 C26
C29	Y
F2	Z2 R2 VR1
L2	
Q11	
R26	TB2
TP3	TP4
T1	J2
U13	

2030A-1001 (2 of 2)

Figure 8-1. A1 Printer, Main PCB Assembly (cont)

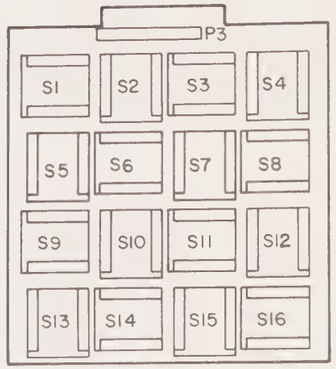


2030A-1604

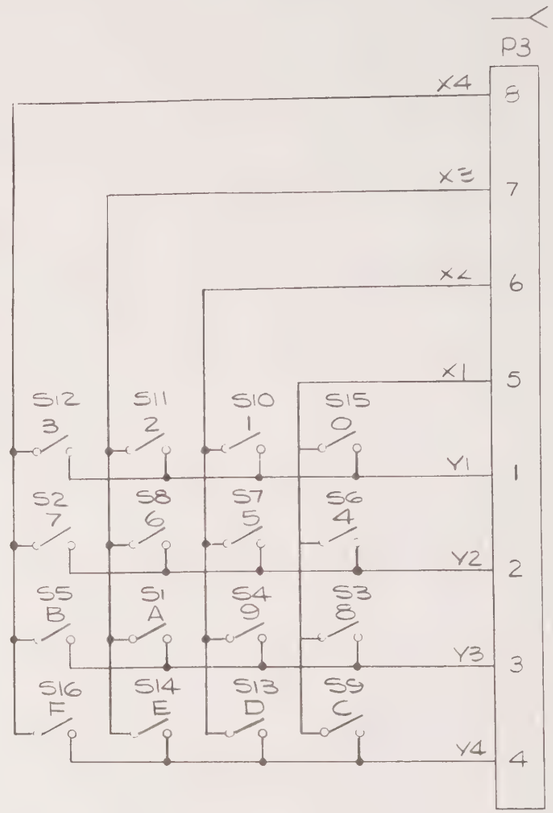


2030A-1004

Figure 8-3. A2A1 Interconnect PCB Assembly



2030A-1602

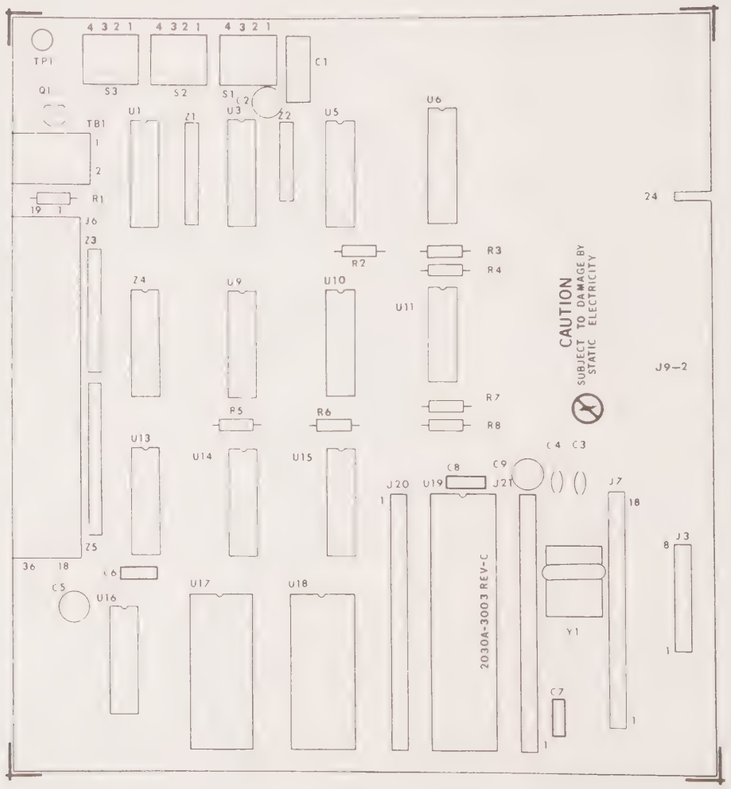


NOTES UNLESS OTHERWISE SPECIFIED

1. ALL GRAPHIC SYMBOLS ARE IN ACCORDANCE WITH ANSI Y32.2 AND Y32.14.

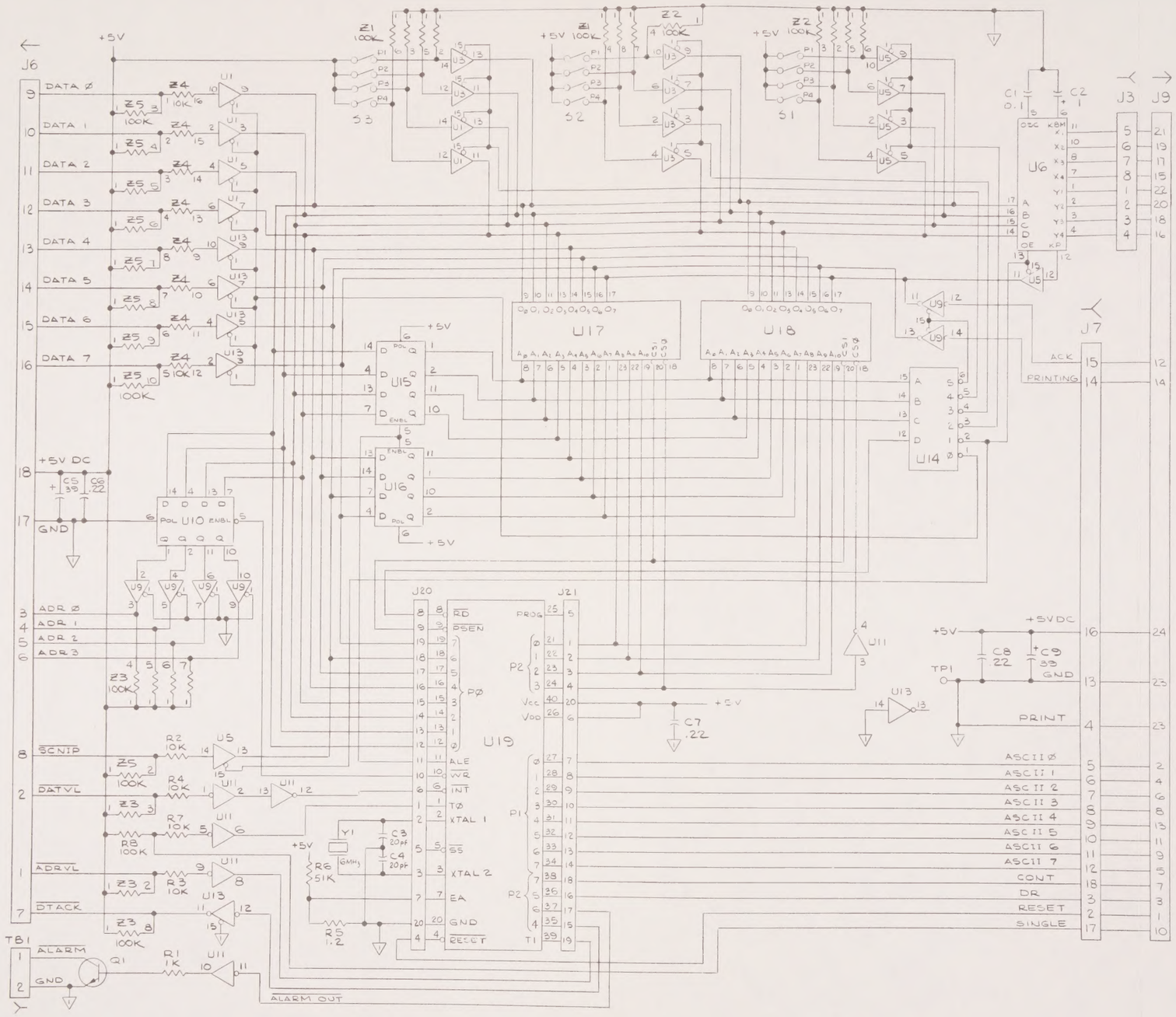
2030A-1002

Figure 8-4. A3 Keyboard PCB Assembly



2030A-1603

Figure 8-5. A4 PTI System Interface PCB Assembly



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCE IS IN OHMS
   ALL RESISTORS 1/4 W, 5 %
2. ALL CAPACITANCE IS IN MICROFARADS
3. ALL GRAPHIC SYMBOLS ARE IN ACCORDANCE WITH ANSI Y32.2 AND Y32.14

REF DES	+5V	GND
U1	16	8
Z1	—	1
U3	16	8
Z2	—	1
U5	16	8
U6	18	9
Z3	1	—
Z4	—	—
U9	16	8,1
U10	16	8,6
U11	14	7
Z5	1	—
U13	16	8,14,15
U14	16	8
U15	16,6	8
U16	16,6	8
U17	24,21	12
U18	24,21	12
U19	40,26	20

REFERENCE DESIGNATIONS	
LAST USED	NOT USED
C3, Q1 R8, U19 TB1 J21 Z5	J1, 2, 4, 5, 8-13 U2, 4, 7, 8, 12

2030A-1003

Figure 8-5. A4 PTI System Interface PCB Assembly (cont)

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